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19 April 1985

# USSR Report

EARTH SCIENCES



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## METEOROLOGY

## CLOUD-SEEDING FOR REGULATING PRECIPITATION IN MOSCOW AREA

Moscow LENINSKOYE ZNAMYA in Russian 9 Dec 84 p 4

[Article by N. Tsarapkin]

[Excerpt] Four airplanes took off from the Bykovo airport before dawn, on instructions from the experimental-industrial laboratory. A few minutes later, they flew into a thick cloud layer northwest of Moscow and released trails of a white substance. Snow began to fall. At the wish of man, the clouds dropped precipitation that was due for Moscow on fields near the capital city.

"The cost of removing a layer of snow 8 centimeters thick from the [streets] of the city is one million rubles. Ordinarily, as much as 150 centimeters of snow falls in the course of a winter," related A. Pimenov, head of the experimental-industrial laboratory. "But the amount of precipitation has been increasing, and the reason for this is that the air over Moscow is saturated with aerosol particles. Penetrating the cloud layer, they contribute to the formation of rain and snow. Observations made in recent years have shown snowfall in Moscow to be 20 percent greater than the average for Moscow Oblast, because of aerosol and thermal effects and other factors. It is no random matter that our experimental-industrial laboratory is under the direction of the Moscow Main Administration of Streets and Roads. Constant monitoring of the amount of precipitation in the capital is a major concern of our specialists.

"We do not aim to totally preclude rain or snow from falling on streets of Moscow. The question is one of regulating the amount of precipitation.

"The redistributing of rain and snow is based on the method of artificially inducing precipitation by seeding clouds with a reagent which causes ice crystals to grow. Dry ice made in refrigerators is used for this purpose.

"However, norms for the amount of reagent introduced into clouds must be determined before airplanes are sent aloft," said A. Pimenov in conclusion. "The temperature and thickness of the cloud layer, wind velocity, characteristics of turbulent exchange in clouds and other synoptic conditions must be known for this purpose. The laboratory obtains these parameters from various scientific institutions. An operator on the lead airplane makes corrections in these parameters and determines the course for all the aircraft."

CSO: 1865/191

LIGHTWEIGHT AEROLOGICAL RADIOSONDE "MARZ"

Moscow GUDOK in Russian 18 Dec 84 p 4

[Article by A. Lupenko]

[Excerpt] A new, small aerological radiosonde was tested not long ago in the Urals. It has been given the name MARZ by its developers, who are specialists of the Moscow Special Design Bureau of Hydrometeorological Instrument Building. This instrument will gradually replace older types which are 'veterans' of flights into the atmosphere. What are the merits of this new radiosonde?

It is much lighter than its predecessors. Older sondes are based on tubes and powered by large batteries, each of which weighs 640 grams. But the power source of the MARZ is only one-fifth to one-sixth as large. The 'novice' itself and all of its devices and sensors have an overall weight of only 430 grams, i.e., it is lighter than a single battery of its older brother.

The new radiosondes measure temperatures ranging from minus 80 to plus 50 degrees Celsius and relative air humidity ranging from 15 to 98 percent. Moreover, their flight ceiling has been increased to 30 kilometers. The "Gidrometpribor" (hydrometeorological instrument) experimental plant in Sverdlovsk has already produced several tens of thousands of these radiosondes.

Observations of the atmosphere with the aid of MARZ radiosondes make it possible to increase the reliability, accuracy and dependability and therefore the overall quality of weather forecasts.

CSO: 1865/191

# LASER-EQUIPPED UNIT FOR MODELING ORIGIN OF TYPHOONS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 7 Feb 85 p 2

[Text] Vladivostok -- Raging tropical typhoons are generated and subside here several times a day. Perhaps it is more accurate to say that they do not subside, but are turned off by means of an ordinary knife switch. Scientists are studying the mechanism of ocean hurricanes with the aid of an original unit installed in a laboratory of the Far East Hydrometeorological Institute.

Scientists of Belorussia sent the institute this 'house for hurricanes.' It is a transparent vessel equipped with various devices for modeling conditions of the origin of typhoons. Its equipment also includes a laser which penetrates warm tropical waters like a knife, giving rise to the first whirlwind of a hurricane. One interesting fact is that photographs of typhoons taken from space very much resemble photographs of the laboratory hurricanes.

A laser frequency gauge will soon be added to the new unit. This instrument is connected to a computer. This will make it possible to monitor changes in the velocity of a whirlwind at any moment and therefore come closer to ascertaining not only the mechanism of the origin of typhoons, but also secrets of their movement.

FTD/SNAP  
CSO: 1865/233



UDC: 523.033

#### GREENHOUSE EFFECT IN EARTH'S PRIMORDIAL ATMOSPHERE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 277, No 2, Jul 84 (manuscript received 2 Mar 83) pp 339-342

KONDRAT'YEV, K. Ya., corresponding member, USSR Academy of Sciences, MOSKALENKO, N. I. and PARZHIN, S. N., Limnology Institute, USSR Academy of Sciences, Leningrad

[Abstract] An attempt is made to calculate the greenhouse effect in the earth's primordial atmosphere. The period of formation of the primordial atmosphere was not very long; therefore, the greenhouse effect and mean global temperature of the surface of the planet are calculated for solar insolation about two-thirds of the present quantity. The mean planetary albedo was assumed equal to 0.2, since the soil was not heavily eroded at that time. Products of degassing of the earth, which primarily formed the primordial atmosphere, were assumed to consist of 84.42% water vapor, 14.29% carbon dioxide, 1.06% methane, 0.23% nitrogen, 0.1%  $\text{SO}_2 + \text{OCS}$ . The earth's cloud cover at that time was probably at an altitude of 20 to 30 km and was quite stable, consisting of  $\text{H}_2\text{SO}_4$  droplets. A table presents surface temperatures of the planet as a function of assumed partial pressure of  $\text{CO}_2$ . Figures 1, tables 1: references 8: 6 Russian, 2 Western.  
[147-6508]

UDC 551.577.5:551.525.2

#### REGULARITIES IN RECENT CHANGES IN SURFACE AIR TEMPERATURE AND ATMOSPHERIC PRECIPITATION FIELDS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOGRAFICHESKAYA in Russian No 6, Nov-Dec 84 (manuscript received 29 Feb 84) pp 29-39

KOVYNEVA, N. P., State Hydrological Institute

[Abstract] The regularities and quantitative estimates presented in this article are based on instrumental measurements during the last 100 years.

During this period the mean annual surface temperature for the northern hemisphere varied in the range  $\pm 0.5^{\circ}\text{C}$ . In the modern period the principal patterns of warming were as follows. As an average for the winter season warming in the northern hemisphere is accompanied by very strong warming in the Atlantic sector of the Arctic. A considerable increase in air surface temperature is occurring over the North Pacific Ocean and on the eastern coast of North America. In these regions the temperature changes are somewhat greater in scale than in the regions of increase in air surface temperature on the Eurasian continent. Despite warming of the hemisphere in a number of regions of Eurasia and in northwestern North America it will become colder. In the autumn the pattern of temperature changes is similar to winter (except for northern Europe and northwestern North America). The region of a temperature decrease in Central Asia is more extensive. In the autumn the scale of changes is approximately half that of winter. In the summer warming is manifested to a greater degree in the high latitudes of the eastern and the temperature latitudes of the western hemispheres. The scale of summer changes is considerably less than in the other seasons of the year. In spring the greatest temperature increase during warming of the hemisphere is occurring in the Atlantic sector of the Arctic, in the northeastern part of America and in the central part of Asia. The regions of the continents characterized by a temperature decrease occupy a lesser area than in all the remaining seasons of the year. With respect to changes in the fields of seasonal sums of atmospheric precipitation during warming of the hemisphere, during all seasons there is a zone of decrease in precipitation in the temperature latitudes which affects extensive regions on the continents and oceans. As an average for the year the region of decrease in precipitation on the continents is situated between  $35^{\circ}$  and  $50^{\circ}\text{N}$  and includes the steppe and wooded steppe regions of the USSR and the United States. There are quite significant differences in the nature of changes in the quantity of precipitation in the western and eastern parts of the northern hemisphere. In the northern hemisphere virtually during the entire year the region of a decrease in precipitation is situated to the south of  $50^{\circ}\text{N}$ . In the autumn the decrease is appreciable, but on the eastern coast of North America the quantity of precipitation is increasing. In regions adjacent to the Gulf of Mexico precipitation is increasing in all seasons. Over the ocean areas in all seasons of the year, other than winter, the changes in precipitation have an almost zonal character; the greatest changes in the quantity of precipitation are observed in winter and autumn in the intracontinental regions. The geographical distribution of norms of atmospheric precipitation are very sensitive to processes of global warming and cooling and the changes frequently have a different sign in different regions and in different seasons. The results of these temperature and precipitation changes are represented in a series of seasonal maps. Figures 2; references 26: 15 Russian, 11 Western.

[204-5303]

# TYPHOON STUDIED FROM IL-18 LABORATORY AIRPLANE

Moscow VOZDUSHNYY TRANSPORT in Russian 21 Feb 85 p 4

TSEYUKOV, V.

[Abstract] The article records conversations with participants in a recent expedition of 25 Soviet and Vietnamese meteorologists.

The group made six flights into typhoon "Warren" late in 1984, spending a total of 32 hours inside the storm. The flights were made in an IL-18 laboratory airplane. The expedition included specialists of the Central Aerological Observatory of the USSR State Committee on Hydrometeorology and Monitoring of the Natural Environment, and also associates of the Institute of Experimental Meteorology, according to N. Vinnichenko, head of the observatory's flight scientific research center. The expedition was supported by a crew from the flight-testing complex of the State Scientific Research Institute of Civil Aviation. This crew was headed by senior test-pilot Vladislav Nikolayevich Kotovich. Its other members included test-pilot Khaydar Sulimanov, navigator Aleksandr Lalykin, flight engineer Sergey Yerastov, and radio operator Nikolay Ryabov. Kotovich praised the performance of both the crew and a team of aircraft technicians headed by engineer Kirill Krotov. The IL-18 made flights in the typhoons at altitudes of 500, 1,800 and 4,700 meters.

Chief engineer Aleksandr Viktorovich Litinetskiy, an associate of the aerological observatory, mentioned that the typhoon studies were the first that he and his colleagues had made. He explained that the purpose of the expedition was to understand better the physics of tropical cyclones, particularly the way that they form and subsequently develop. The data can provide a basis for forecasting movements of typhoons and determining their intensity. The equipment carried by the airplane included several sets of measuring instruments for studying the structure of meteorological fields and clouds of tropical cyclones. The sets included thermodynamic and radar apparatus. Part of the instruments were developed at the aerological observatory. The flights were made while the typhoon was in the South China Sea. During the flights, weather conditions inside the cyclone were observed by flight aerologist Nikolay Vetrov; Vladimir Yermakov, head of the radar complex; and synoptic meteorologist Nikolay Alyab'yev, who compiled operational maps of cloud cover.

FTD/SNAP  
CSO: 1865/259

HAILSTORM FORMATION PROCESSES STUDIED AT GEOPHYSICS INSTITUTE

Tallinn SOVETSKAYA ESTONIYA in Russian 31 Jan 85 p 3

PRIYMAN, R., senior science associate, Tartu State University, and  
TUBLI, M., journalist

[Abstract] The authors comment in general on research of atmospheric processes which cloud-physics specialists have been doing with the aid of spacecraft, computers and other advanced technology, and on applications of this research in weather forecasting and modification. An editorial preface to the article notes that atmospheric research data obtained with the aid of modern equipment were presented at the Ninth International Conference on Cloud Physics, which was held in Tallin. Representatives of 20 countries attended the conference.

The authors turn from a general discussion to focus on studies of hail processes at the High-Elevation Geophysics Institute of Nal'chik. Specialists of the institute studied mechanisms of the origin and growth of clouds. Physical-mathematical models of hail-bearing clouds were developed which reportedly make it possible to study all possible changes occurring in the clouds, forecast their behavior and prevent damaging hailstorms. Precise charts were prepared for seeding clouds with a special reagent that is harmless to the environment. Cloud-seeding experiments were performed in the North Caucasus Mountains and the Fergana Valley.

Prompt identification of threatening clouds and seeding of their centers with a reagent have been found to be more than 70 percent effective in eliminating hailstorm damage, according to the authors. They mention that hail-prevention services have been in operation in Krasnodar Kray and in the Azerbaijan, Armenian, Tajik, Uzbek, Georgian and Moldavian republics. The hail-prevention stations reportedly succeeded in reducing the country's total area of hail damage by 75-80 percent, on the average, from 1976 to 1983.

FTD/SNAP  
CSO: 1865/251

OCEANOGRAPHY

UDC 551.464.681.1/4

TWO-COMPONENT LASER DOPPLER ANEMOMETER FOR MARINE RESEARCH

Tallinn IZVESTIYA AKADEMII NAUK ESTONSKOY SSR: FIZIKA, MATEMATIKA in Russian  
Vol 33, No 4, 1984 (manuscript received 18 Oct 83) pp 454-456

[Article by A. Rozenshteyn and F. Frishman, Thermal Physics and Electrophysics  
Institute, Estonian Academy of Sciences]

[Text] Instruments with a high spatial and temporal resolution, not perturbing the investigated medium, are required for investigating small-scale marine turbulence. These requirements are best satisfied by submersible probes with a laser Doppler anemometer (LDA) [1]. Attempts at developing submersible probes with a single-component LDA are now known.

In this communication we describe a submersible probe with a two-component LDA intended for measurements of the kinematic parameters of underwater currents from aboard a scientific research ship. Figure 1 is a structural optical-mechanical diagram of the probe. The laser Doppler anemometer is assembled in a differential scheme operating in a "forward scattering" regime. The ray from a He-Ne laser (1) ( $\lambda = 0.63 \mu\text{m}$ ,  $P = 15 \cdot 10^{-3} \text{W}$ ) passes through a Bragg optical-acoustical modulator (OAM) (2) ( $\nu_m = 21.0 \text{ MHz}$ ). The optical system (3-6) transforms the divergent beams into parallel beams and directs them to a focusing lens (7). After the focusing lens the dividing cubes form a pair of rays AA' and an orthogonal pair BB'. Both pairs pass through transparent windows and form two orthogonally oriented interference patterns formed at a distance of 250 mm from the body (16) of the probe. The receiving systems (9-12) are situated in individual blocks (17) oriented on the bisector of the angle of intersection of the rays AA' and BB'.

The following are concentrated in the body of the probe: laser (1), OAM (2) with a power supply system (14), the LDA optical transmitting systems (3-8), LG high-voltage power supply units and photomultiplier (15), as well as an electronics block for the conversion of information and connection with on-board systems (13). In two blocks (17) in remote pylons (18) there are receiving optical systems (9-10), photomultipliers (11), blocks for preamplification and filtering of signals (12); in the third block there is a pressure sensor (20). All probe blocks are made in the form of cylinders with fairings (Fig. 2) [a photograph, not reproduced here]. The probe design precludes the influence of the boundary layers forming during the flow of underwater currents around the probe on the parameters of the current in the region of extraction of information in the velocity range up to 10 m/sec.



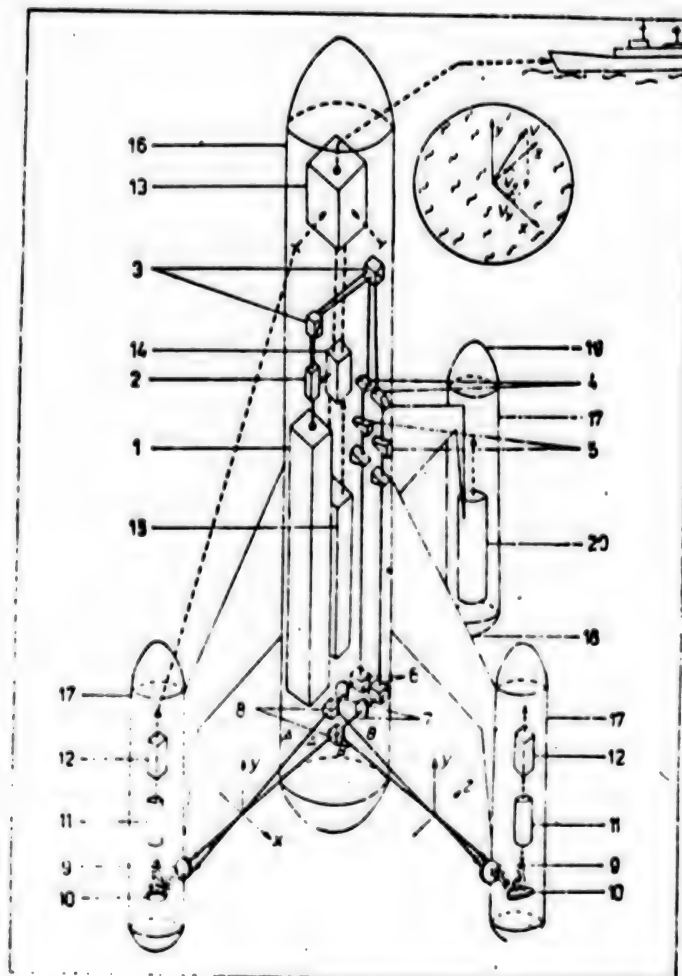


Fig. 1.

The system for supply of electric current and for the processing of information from the LDA is aboard the ship. The system for the processing of information, including a processor of the "DISA 551.20" type [2] and a discrete read-out system (DRS) of the "counter" type [3] with output to an "Elektronika 60 M" computer, makes it possible to provide "instantaneous" values of projections of the velocity vector with a sampling frequency of  $2 \cdot 10^2$  measurements per second (for the DRS) and an error in a unit measurement of 0.1%. The lower limit of the determined velocities is 5.0 mm/sec. The volume of data extraction is about  $0.6 \text{ mm}^3$ . The probe with the LDA was tested aboard the scientific research ship "Ayu-Dag" under expeditionary conditions. It can be used in measurements of both the absolute velocity and the characteristics of turbulence of sea currents.

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CSO: 1865/218

HUNGARIAN ENTERPRISES AT 'GEOEXPO-84' EXHIBITION

Moscow ECOTASS in English No 33, 3 Sep 84 p 8

[Statement by Imre Fazakas, representative of the foreign trade enterprise "VIDEOTON"]

[Text] "We showed at this exhibition in Moscow part of a computer complex which is an upgraded version of the automated geophysical navigational complex 'Mars' jointly developed in the 1970's by the Budapest Institute 'ELGI,' the electronic enterprise 'VIDEOTON' and the USSR Ministry of Geology on the basis of the computer 'ES-1010.' The new complex supplemented with a 'ES-1011' computer can cope with the tasks of geophysical, geoacoustic and phototelevision data processing during oceanological studies simultaneously with navigational tasks. Such systems are now used by more than 30 Soviet ships for oceanological research. The system displayed at this exhibition will also be installed on a Soviet ship. Besides, such automated complexes are used by geologists in Tyumen to conduct geophysical studies of the earth's crust.

"'VIDEOTON' specialists have developed a containerized geophysical computer center for geophysical expeditions to difficult-of-access areas with rigorous climate conditions, including the Extreme North, Siberia and Central Asian deserts.

"'VIDEOTON's' annual supplies of equipment for geological and geophysical studies to the Soviet Union stand at over 10 million rubles. 'VIDEOTON' specialists maintain close cooperation also with colleagues in other Soviet ministries, including the USSR Ministry of the Gas and Oil Industries, and with scientists of the Soviet Academy of Sciences."

CSO: 1865/149

INTERNATIONAL EXHIBITIONS 'GEOEXPO-84', 'GEOKARTA-84'

Moscow ECOTASS in English No 33, 3 Sep 84 p 8

[Text] Foreign firms--participants in the exhibitions. Two international exhibitions, "GEOEXPO-84" and "GEOKARTA-84," have been held at Krasnaya Presnya Exhibition Grounds in Moscow. The exhibitors included more than 160 firms, factories and organizations from 21 countries, namely, Belgium, Bulgaria, Britain, Hungary, the German Democratic Republic, West Germany, Italy, Canada, the People's Republic of China, Cuba, the Netherlands, Poland, the Soviet Union, the United States, Finland, France, Czechoslovakia, Switzerland, Sweden, Yugoslavia and Japan.

A number of international organizations, including UNESCO, the International Commission on the Geological Map of the World and the Union of Geological Sciences, also took part in the exhibitions.

Exhibitions dealing with geology have already been held in the Soviet Union. A show concentrating on geodesy and geophysics was held in 1971, and there were three exhibitions devoted to geological exploration techniques and instruments. But "GEOEXPO-84" was much more representative than its predecessors, covering a substantially wider range of subjects and featuring many more exhibits. Besides, it was supplemented by "GEOKARTA-84."

The two shows accompanied the 27th International Geological Congress held in Moscow, which offered their participants a possibility to demonstrate their achievements not only to Soviet specialists but also to scientists from many other countries.

The Soviet section, prepared by 25 ministries and departments, was the most representative. Many of the 2,000 exhibits on display there were products of joint development efforts by specialists and scientists of countries grouped in the Council for Mutual Economic Assistance (CEMA).

A TASS correspondent has met with representatives of several foreign firms which participated in the exhibitions.

CSO: 1865/149

#### CATAMARAN RECONNOITERS SEA DEPTHS

Moscow MOSCOW NEWS in English No 49, 1984 p 4

[Article by Larisa Chechbyova]

[Text] The first catamaran in Soviet shipbuilding, earmarked for geological prospecting of hard-mineral resources in the shelf zone, has been added to the fleet of reconnoiters of the sea depths in the Maritime Territory. Compared with the technical prospecting of hard-mineral resources in the shelf zone the size of the "Geolog Primorya" is not that great. It is 35 m in length, 18 m in width and has a power supply of 400 KW. Its two 305 HP engines make it possible to reach a speed of 9 knots and have the range of an autonomous run of 1,300 miles.

Yuri Rechkin, chief of the department of sea geological prospecting at the Ministry of Geology of the Russian Federation, said: "The success of the search and prospecting of hard-mineral deposits, lying in the loosened sediments of the sea depths up to 50 m and geologically inseparable from the continent, largely depends on the productivity of drilling. The attempts to adapt other ships have proved unsuccessful: the productivity of drilling was low."

The catamaran, developed by a group of Vladivostok designers under the supervision of Viktor Obrazkov, has solved most of the problems that hampered work on the sea shelf. Their catamaran differs both from the two-body wooden Polynesian boat, known from time immemorial, and from the modern boat used for prospecting and developing oil and gas deposits on the shelf by virtue of its original design which fully meets the specific requirements of the search for hard minerals.

The bridge linking the two hulls forms a deck which is twice as big as that of one-hull ships of the same type. The entire drilling complex is situated on this deck. A drilling rig is mounted in the stern. The load on the upper point for extracting the drilling pipes is over 30 tons. A one-hull ship will not endure this--it will capsize. But it is impossible to overturn a catamaran even with an extreme effort, as the main characteristics of its stability are almost ten times higher.

The capabilities of a catamaran in a rough sea or a storm are invaluable. In such conditions drilling has to be stopped as the drill pipes will either damage the vessel or be carried away. In such a situation the drillmen disconnect the pipes from the installation, the vessel moves to a safe distance and waits till the storm ends. Then it returns to the well and continues drilling.

The ship has a high maneuverability as a result of the large spacing of the screw propellers (11 m) and a special steering device: it can move sideways or spin. Added to this, the amplitude of the catamaran's rolling is three-four times lower than that of one-hull ships. For example, at wind force 3 the ship amplitude is two-three degrees. The boat is secured to the drilling point by four anchors weighing some 900 kg.

Between the two hulls there is a hydrofoil preventing pitching and heaving. In rough weather the hydrofoil increases the boat's resistance to a large wave and its speed remains practically the same.

In the ship's superstructure there are a mess room, a galley, laboratories and workshops. There is accommodation for thirty-six crew and drillmen in two-bed rooms.

The "Geolog Primorya" has begun operating in the open seas of the Far East.

CSO: 1852/6

ATLANTIC TEST CRUISE OF OCEANOGRAPHIC SHIP 'PETROV'

Moscow IZVESTIYA in Russian 31 Dec 84 p 6

[Interview by O. Dzyuba with Lev Mikhaylovich Khitrov]

[Excerpt] The first test cruise of the "Akademik Boris Petrov", a scientific research ship of the USSR Academy of Sciences, has been completed. It traveled more than 11,000 miles. Behind it are weeks of studies, as well as trials of sophisticated research systems. Lev Mikhaylovich Khitrov, head of a laboratory of the USSR Academy of Sciences' Institute of Geochemistry and Analytical Chemistry imeni Vernadskiy, told our correspondent about the expedition's work in the expanses of the Atlantic Ocean.

"The 'Akademik Boris Petrov' is the lead vessel of a new series. What are the principal differences between it and other scientific ships? From the standpoint of the nature and density of their scientific instrumentation, the ships of the new series have the highest capacity, although they are much smaller than many research ships that are in service. The new ships' main feature is an integrated scientific system. This means that all of their sensing devices and apparatus transmit information immediately to laboratory computers, and if these computers' capabilities are insufficient to process it, then the ship's main computer is switched in automatically. This computer has a bank of data that are 'tied' to readings of a satellite navigation system and an automatic weather station."

"Scientists now maintain that it has become necessary to study processes on a scale almost as small as a single drop in order to understand what is taking place in water many kilometers deep."

"The concept of a 'density discontinuity' layer exists in oceanology. Such a layer is a kind of screen which separates the surface layers of water from the deep ones. If the layer is continuous, vertical exchange is impeded, and if it is not, mass transfer takes place in a different manner. Such phenomena can be completely modeled just by studying what takes place on the micro-structure level. An automatic probe on board the ship makes it possible to ascertain changes in density, salinity and temperature in layers as thin as a few centimeters!



"We also tested a multiple-beam sonic depth-finder--a highly efficient instrument for studying floor relief. Whereas an ordinary sonic depth-finder gives only the floor's profile, the multiple-beam one gives a picture of a strip up to 3 kilometers wide. Fifteen acoustic emitters send beams through the mass of water, and a three-dimensional representation of the floor appears on the screen of a video terminal and subsequently on paper after the information has been processed.

"Work was done on studying chlorophyll content with the aid of lasers. The manner in which a current travels in the ocean can be determined on the basis of chlorophyll content."

"Specialists of Finland worked on board the ship throughout the cruise. What was the nature of your cooperation with colleagues from this country?"

"Specialists of the 'Hollming' firm, which built the ship, participated constantly in the tests and adjusting of instruments. After all, the next ships in the new series are being built at this firm's shipyard, and experience obtained during the cruise is of tremendous importance for both sides. I think that our cooperation has been proceeding quite productively."

FTD/SNAP  
CSO: 1865/202

19 April 1985

## SPEED AND DIRECTION OF SEA CURRENTS INDICATE MINERAL DEPOSITS

Moscow TASS in Russian 1019 GMT 12 Jan 85

[Text] Moscow, January 12 (TASS)--A new method for measuring the speed of sea currents developed by a group of Soviet scientists may help decipher many blank spots of the world ocean, the bi-weekly "Moscow News Information" writes. They have found out that the peculiarities of the distribution of speed and direction of currents at various depths reveal a vast data on pockets of minerals on the sea bottom. Experiments were held in Lake Onega and the Gulf of Riga in the Baltic.

Instruments stationed aboard a moving ship by Karelian and Leningrad researchers registered full information on the speed of the current along the entire route and at all depths simultaneously, using sound waves which minutely registered the slightest changes in the current. The speed of the ship itself affected in no way the accuracy of measurement, being negligible compared with the speed of 1.5 km per sec at which sound travels in sea water.

The new installation is hooked up to an electronic computer which records all data on the time of work, the ship's location and direction, depth of measurement, and the speed of current. Sea geologists will only have to indicate on the world ocean map the spots they consider promising mineralwise.

CSO: 1865/221

19 April 1985

## MANNED SUBMERSIBLE 'RUBIN-30' FOR HYDRAULIC ENGINEERING STUDIES

Moscow KOMSOMOL'SKAYA PRAVDA in Russian 22 Dec 84 p 4

[Article by R. Kozlov]

[Excerpt] Our country's first submersible craft which is specially designed for hydraulic engineering studies, the "Rubin-30", has been tested in the Gulf of Finland, where installations are under construction for the purpose of protecting Leningrad against floods.

The main purpose of these exploratory operations is to provide conclusions in regard to the character of the sea bottom along the route of the dike. These studies are very important. A highway will run along the top of the dike, and consequently no settling of any section of it must occur.

How can underwater reconnaissance be made easier and more effective? This is where submersible craft will help.

We left Lomonosov on board the vessel "Sprut", which is specially equipped for work with the new hydrostatic craft "Rubin-30", whose plans were drawn up by Leningrad designers.

The "Sprut" approached the place where trials were scheduled. Divers on the vessel's stern uncovered the hydrostatic craft. It presents the appearance of a brightly painted cylinder with six windows which provide vision all around. The cylinder is installed in a special frame, to which the cable of a hoisting device is fastened. In an emergency situation, this heavy frame remains on the bottom, while the cylinder rises to the surface. The hydrostatic craft is equipped with air-supply, power-supply and communications systems.

FTD/SNAP

CSO: 1865/202

SHIP 'SHULEYKIN' TO DO WEATHER STUDIES IN NORTH ATLANTIC

Leningrad LENINGRADSKAYA PRAVDA in Russian 29 Jan 85 p 4

[Article by A. Kozlovskiy]

[Text] The scientific research ship "Akademik Shuleykin" set out from Leningrad yesterday on another cruise to the North Atlantic.

This ship and the ships "Professor Mul'tanovskiy" and "Professor Molchanov" will jointly conduct comprehensive expeditionary studies in the part of the ocean running from Iceland to Scandinavia. The purpose of the expedition is to study features of the seasonal rearrangement and development of synoptic processes over this area of the ocean, and also to make a quantitative evaluation of the transfer of heat from the equatorial zone of the Atlantic to the Central Arctic Basin. In addition to meteorological, aerological, hydrologic, hydroseismic and other observations, pictures from artificial Earth satellites will be received on board the vessels, and warnings will be prepared of dangerous weather phenomena forming in the North Atlantic.

FTD/SNAP  
CSO: 1865/251

19 April 1985

## AIRBORNE INSTRUMENT FOR HYDROCHEMICAL ANALYSES

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 9 Feb 85 p 4

[Text] Information on the salinity of water is needed by land-reclamation workers who calculate irrigation norms and also by municipal-services workers, fish hatchery workers, and ecologists. Salinity measurements are usually made by teams of hydrologists. But scientists of the Taganrog Radio Engineering Institute imeni Kalmykov think that it is no longer necessary for such teams to walk along riverbanks and lake shores; they can be flown over in an airplane or a helicopter. The scientists have developed a portable instrument which analyzes radio waves reflected from water and determines salinity in accordance with changes in the signal. Initial tests of this instrument have already helped to save about 150,000 rubles; an evaluation of the hydrochemical condition of the Balaya River took only two weeks.

FTD/SNAP

CSO: 1865/233



SHIP 'KARPINSKIY' TO TEST GEAR FOR ATLANTIC FLOOR STUDIES

Leningrad LENINGRADSKAYA PRAVDA in Russian 7 Feb 85 p 4

[Article by K. Aleksandrov]

[Text] Last night the scientific research ship "Akademik Aleksandr Karpinskiy" sailed from Leningrad, setting a course for the Atlantic.

Yu. I. Matveyev, deputy director of the All-Union Scientific Research Institute of Ocean Geology, reported that the purpose of the expedition is to test technical equipment for large-scale geophysical studies of the upper portion of bottom sediments, and also new equipment for taking samples at depths as great as 6,000 meters.

During the cruise the "Akademik Aleksandr Karpinskiy" will continue to uncover secrets of the geological structure of the world's oceans. The expedition is planned to last 45 days. Leningrad researchers who have developed a whole series of unique instruments will get a chance to test them in operation. In particular, numerous parameters of physical properties of bottom sediments will be obtained from the depths of the Atlantic. The new equipment will help to broaden substantially geologists' possibilities for better understanding the floor of the oceans.

After the test cruise is completed, the ship will set out for a working cruise in areas of the Pacific Ocean this summer.

FTD/SNAP  
CSO: 1865/233

NAVAL UNIT'S WORK ON FIVE-VOLUME ATLAS OF WORLD'S OCEANS

Leningrad LENINGRADSKAYA PRAVDA in Russian 19 Jan 85 p 4

[Article by V. Yeliseyev]

[Text] Many vessels and ships are now cruising our planet's seas and oceans. Regardless of the ministry or agency to which these vessels belong, however, in our country the support of their safe navigation is concentrated in a single place: the Main Administration for Navigation and Oceanography of the USSR Ministry of Defense. One of this administration's divisions -- the Central Cartographic Production Unit (TSKP) of the Navy -- is the oldest Soviet marine cartographic enterprise and the only one of its kind. It is located in Leningrad.

"How is a modern nautical chart created?" said Captain 1st Rank S. V. Val'chuk, head of the TSKP, repeating my question. "Such a chart is difficult to create by manual methods. Computers, electronic coordinatographs and other technology are therefore widely used. This technology takes the place of heavy manual work by specialists, heightening the accuracy and reliability of charts.

"One of the unique projects which marine cartographers have been pursuing over a number of years is the preparation and publication of a five-volume 'Atlas of the Oceans'. It is a basic publication and at present the only one of its kind in the world from the standpoint of the amount of information included in it. Fleet Admiral of the Soviet Union S. G. Gorshkov, commander-in-chief of our country's Navy and twice Hero of the Soviet Union, is the editor in charge of this atlas.

"How are the world's oceans divided among the atlas' volumes? The first provides exhaustive oceanologic, hydrographic, ecological, hydrometeorological and historical information on the Pacific Ocean. Volume Two is the Atlantic. Incidentally, the USSR State Prize was awarded for the work on the first two volumes of the 'Atlas of the Oceans'. The third volume is devoted to the Arctic Ocean. The fourth volume, on which work is now in progress, will include information on straits. The fifth volume promises to be interesting; it will be a broad, popular-scientific treatment of the topic 'Man and the Ocean'. The 'Atlas' will become an exhaustive cartographic encyclopedia."

MARINE SOUND-PROPAGATION METER REFINES DEPTH-FINDER READINGS

Moscow IZVESTIYA in Russian 5 Feb 85 p 2

[Article by S. Krayukhin]

[Text] A steel sonde which Anatoliy Ivanovich Kashcheyev was holding in his hands is intended for lowering into the sea and ocean depths, as well as into the waters of lakes and reservoirs.

The object is connected by a flexible cable with an instrument on which greenish numbers light up. The deputy head of the department of optics and surveying of the coastal shelf explained that this is the "Mis-1", which is an acronym of 'marine sound velocity meter.' The small instrument, which employs microcircuits, weighs only 10 kilograms and can be carried on small boats and launches.

At the present time the "Era-1" sonic depth finder is used for measurements of the shelf of the Caspian, Black, Barents and other seas. It was developed by specialists of the Central Scientific Research Institute of Geodesy, Aerial Photography and Cartography, in collaboration with Leningrad industry. As is known, the sonic depth finder uses reflected ultrasound for measuring the depth of the sea. The rate of propagation of sound in water depends on the water's temperature and salinity. The new "Mis-1" instrument will be able to detect this difference in remote sectors of the sea and make corrections in the readings of the sonic depth finder.

The technical innovation developed in the city on the Neva has passed state testing successfully. Its series production will begin next year.

FTD/SNAP  
CSO: 1865/254

ACOUSTIC UNIT FOR NONSTOP MEASURING OF OCEAN CURRENT VELOCITY

Kishinev SOVETSKAYA MOLDAVIYA in Russian 9 Feb 85 p 3

[Text] Petrozavodsk -- a new method for measuring the velocity of sea currents may help fill in many gaps in science's knowledge of the world's oceans. This method was developed by a group of scientists of Petrozavodsk University and the Northwest Polytechnical Institute, under the direction of Doctor of Technical Sciences E. Matsevich. It has been established that extensive information on deposits of mineral resources in the ocean floor may be derived from features of the distribution of the velocity and direction of currents at various depths.

Up until now, researchers of the ocean's depths have used an ordinary mechanical log of the propeller type for measurements. A vessel must be stopped and the instrument lowered from it to the necessary depth for this purpose. Information on the velocity of a current which is obtained by this method is imprecise. After all, an anchor cannot be dropped in a great depth of water, and it is not easy to hold a vessel motionless in relation to the movement of water. Measurements with the aid of the log are out of the question in windy weather.

Trials of the Karelian and Leningrad scientists' apparatus which were conducted in Lake Onega and the Gulf of Riga on the Baltic Sea have demonstrated the great advantages of this innovation. Instruments on board a moving vessel registered complete information on the velocity of a current over the whole length of the route and at all depths simultaneously. This was done by means of sound waves which sensitively detected the slightest changes in the movement of layers of water. And the speed of the vessel itself had no bearing on the accuracy of measurements, since this speed was insignificantly small in comparison with the rate of propagation of sound in sea water -- 1.5 kilometers per second.

The new unit is linked with a computer, which records in its memory all information on operating time, the vessel's location and direction of movement, the depth at which measurements are made, and the velocity of the current. All that marine geologists have to do is mark locations which they consider to be promising for deposits of minerals on a map of the world's oceans.

FTD/SNAP  
CSO: 1865/251

## PORCELAIN HOUSINGS FOR DEEP-SEA INSTRUMENTS

Moscow PRAVDA in Russian 4 Feb 85 p 7

[Article by G. Pisarenko, academician of the Ukrainian Academy of Sciences, director of the academy's Institute of Strength Problems; G. Okhrimenko, candidate of technical sciences, senior science associate]

[Excerpt] Exploration of the mineral resources of the continental shelf, weather forecasting, the protection of waters against pollution and many other tasks call for a multitude of diverse instruments and devices which are capable of operating at great depths and have a high corrosion resistance. Therefore every instrument must be protected by a strong waterproof housing, which traditionally has been made of stainless steels or costly alloys.

Scientists at the Ukrainian Academy of Sciences' Institute of Strength Problems set themselves the goal of developing housings made of available and inexpensive materials. They narrowed their search to glass, pyroceram and ceramics. These materials have high compression strength, which is just what cylindrical and spherical housings need to 'ward off' hydrostatic pressure. Their brittleness, however, had to be reduced, which proved to be no simple task. But positive results were finally achieved. Experimental glass housings have passed trials and have been introduced at the Ukrainian Academy of Sciences' Marine Hydrophysics Institute, and at the USSR Academy of Sciences' Institute of Earth Magnetism, the Ionosphere, and Propagation of Radio Waves.

But increasing the dimensions of glass housings and also the depth to which they can be lowered proved difficult for purely technical reasons. In particular, costly molds for making blanks had to be developed. The scientists took note of the fact that porcelain items such as insulators, boilers and chemical-equipment vessels in many respects resemble deep-sea housings. Their blanks are made from the raw mass by molding them or casting them into plaster molds. That is simple and acceptable. However, extensive studies of the strength characteristics of porcelain had to be made. The scientists received much help from the workers and engineers of the Slavyansk Ceramics Complex, who made the test prototype.

Under the direction of deputy chief engineer K. Belous and shop supervisor I. Bogatyr', optimum processes for making cylindrical sections with a rounded end from porcelain were developed and introduced. On their basis, housings for a long-term current-velocity meter have been produced. Ocean trials from on board the research ship "Akademik Vernadskiy" have confirmed the suitability of such housings for use in 24-hour drifting buoy stations and long-term automatic buoy stations at great depths.

FTD/SNAP  
CSO: 1865/251



RESEARCH SHIP 'ZUBOV' TO LAUNCH PROBE ROCKETS IN ATLANTIC

Leningrad LENINGRADSKAYA PRAVDA in Russian 21 Feb 85 p 4

[Article by A. Kozlovskiy]

[Excerpt] The scientific research ship "Professor Zubov" left Leningrad yesterday on its 37th cruise.

The main task of the expedition's studies in the Atlantic Ocean will be rocket probing of the atmosphere's upper layers and the ionosphere. In conditions of maximum solar activity, specialists will study physical processing taking place in near-Earth space. Meteorological rockets will be launched in the northern part of the Norwegian Sea and in the equatorial zone.

Much attention will be devoted during this cruise to taking air samples for radiochemical analysis and determining the concentration of radioactive isotopes of natural and artificial origin.

Work on studying the ocean floor's relief in the area of the cruise will be continued, as will aerological, meteorological and oceanologic research, and weather forecasting services will be provided for vessels on the ocean.

FTD/SNAP  
CSO: 1865/259

STUDIES WITH SUBMERSIBLES DURING CRUISE OF SHIP 'KELDYSH'

Moscow NEDELYA in Russian 4-10 Feb 85 p 12

KUROV, GENNADIY

[Abstract] The article records comments of participants in the latest expedition of the "Akademik Mstislav Keldysh", a scientific research ship of the USSR Academy of Sciences' Institute of Oceanology. It returned recently to Novorossiysk following the four-month cruise, which was its ninth.

Doctor of Physical-Mathematical Sciences Oleg Georgiyevich Sorokhtin, head of the expedition, praised its personnel and equipment, which included a large-capacity computer center on board the "Akademik Mstislav Keldysh". Six doctors and 16 candidates of sciences were among the participants in the expedition. Its purpose was to study geological and biological objects in the Pacific and Indian oceans, particularly guyots in the Pacific. Dives to depths as great as 2,000 meters were made by two "Pisces" submersible craft. Sorokhtin related that geological studies were made of the structure of the Mussau trench and submarine ridge, as well as the Tadjoura rift in the Gulf of Aden. In this area, the expedition continued studies of hydrothermal activity and mineral deposits that were begun during the ship's seventh expedition, which was under the direction of A. P. Lisitsin, corresponding member of the USSR Academy of Sciences.

Candidate of Technical Sciences Aleksandr Moiseyevich Podrazhanskiy, deputy head of the expedition, said that 23 dives were made in the course of the studies. Each submersible can carry three persons and operate for 10-12 hours at a time, according to Podrazhanskiy. One craft resurfaced after a strong bottom current hurled it against the Mussau ridge, putting one of its engines out of commission.

Photographs of O. G. Sorokhtin, the "Akademik Mstislav Keldysh", and a submersible were given.

FTD/SNAP  
CSO: 1865/233

## DIGITAL THERMAL GRADIOMETERS FOR MARINE GEOTHERMAL STUDIES

Baku BAKINSKIY RABOCHIY in Russian 22 Jan 85 p 4

ALESKEROV, G., engineer

[Abstract] The article reports on the development and testing of technology for recording temperature gradients in geothermal studies of floor sediments of seas and oceans. It was developed by the special design bureau of geophysical instrument building of the Azerbaijan Academy of Sciences' Institute of Geology, in collaboration with the southern branch of the All-Union Scientific Research Institute of Geophysical Surveying Methods and the chair of automation and telemechanics of the Azerbaijan Institute of Petroleum and Chemistry imeni Azizbekov. Nine specialists who took part in developing the instruments were identified. Their work has been recognized with six certificates of invention.

The article notes that two modifications of the new technology were developed: the TGTSP-1 and the TGTSP-2. "TGTSP" is an acronym of 'submersible digital thermal gradiometer'. Memory microcircuits which ensure reliable digital recording and storage of information are employed in the gradiometers. They are said to be streamlined apparatuses which resemble a miniature cruise missile. The TGTSP-1 is capable of measuring absolute values of temperatures and their gradient in floor sediments at depths as great as 5,000 meters.

The article goes on to relate that trials of the TGTSP-1 were conducted in the Sea of Okhotsk from the "Morskoy Geofizik", a vessel of the Sakhalin Scientific Research Institute of the USSR Academy of Sciences' Far East Research Center, and in the Caspian Sea from the vessel "Bakuvi". A test lot of seven TGTSP-1 apparatuses was produced for the trials. The TGTSP-2 is said to be the world's only digital instrument of its kind which measures thermal conductivity on the basis of new principles. Unlike the TGTSP-1, it is capable of measuring the temperature gradient and thermal conductivity of sediments simultaneously, and its accuracy is higher than its predecessor's. It can operate at any depth in the ocean. The TGTSP-2 passed trials conducted in the Caspian from the "Elm", a scientific research vessel of the Azerbaijan academy. Leading organizations of the USSR Academy of Sciences and the Ministry of Geology reportedly have called both instruments the best of their kind in the world. As compared with foreign counterparts, they have higher ratings for speed, range and precision of measurements, according to the author.

MORE ON USE OF SUBMERSIBLES IN EXPEDITION OF SHIP 'KELDYSH'

Moscow KOMSOMOL'SKAYA PRAVDA in Russian 14 Feb 85 p 4

ZAGAL'SKIY, L.

[Abstract] The article is an interview with two associates of the USSR Academy of Sciences' Institute of Oceanology regarding results of underwater studies which were made during the ninth expedition of the scientific research ship "Akademik Mstislav Keldysh". The two are A. Sagalevich, head of the institute's laboratory for scientific operations with manned submersible craft, and A. Podrazhanskiy, senior science associate and the expedition's deputy head in charge of underwater research. An editorial preface to the interview mentions that Sagalevich and Podrazhanskiy have both made about 100 dives to deep levels of the world's oceans and have spent more than 500 hours under water.

The oceanologists relate that 17 dives were made in line with a geological program during the cruise of the "Akademik Mstislav Keldysh". The expedition's hydronaut contingent consisted of 13 persons: 10 submarines, two mechanics and a meteorologist. Two-man crews made simultaneous dives in each of the two 10-ton "Pisces" submersible craft carried on board the research ship. Motion-picture and still photography were performed and rock samples gathered in the course of the dives. A number of hydronauts, engineers and support personnel receive special mention for their distinguished work in this connection.

Sagalevich and Podrazhanskiy recall that one of the submersible craft was repaired overnight following a collision with the side of a submarine mountain. One of this craft's engines was replaced and a cable was vulcanized so that a dive could be made in the craft the following morning.

A photograph is given showing one of the submersibles in a hoisting apparatus on the side of the ship.

FTD/SNAP  
CSO: 1865/254

UDC: [550.84:553.078]:519(261.  
265/266:54.550.461+550.8

ROLE OF MAJOR SEA WATER IONS IN SORPTION OF Cu(II) BY MANGANESE HYDROXIDES  
(EXPERIMENTAL DATA FOR MODEL OF FORMATION OF POLYMETALLIC ORE NODULES IN  
PRESENT-DAY BASINS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 277, No 2, Jul 84 (manu-  
script received 19 Jan 84) pp 476-479

VARENTSOV, I. M., ZAYTSEVA, L. V. and PUTILINA, V. S., Geology Institute,  
USSR Academy of Sciences, Moscow

[Abstract] Results are presented from experiments on sorption of micro-  
scopic quantities of heavy metals from solutions of NaCl and artificial  
sea water by manganese hydroxides. The significance of the major ions  
in this process is estimated and results obtained are interpreted to ex-  
plain the formation of polymetallic ore nodules in present-day basins.  
Experiments were performed to 22°C with artificial sea water. Cu(II)  
was introduced into solution in a citrate complex. The citrate ion, a  
complex-forming component introduced as a homolog of dissolved organic  
matter, was added as citric acid. The metal concentration in the initial  
solution was 100 µg (cu(II) per liter. The sorbent used was synthetic  
7Å manganate-binnessite. The results indicate that at depths of about  
5 km diffusion of heavy metals in sea water should be increased, favoring  
more active chemisorption accumulation. Figures 1; references 15: 11  
Russian, 4 Western.  
[147-6508]

UDC: 551.214:550.845(26)

HYDROCHEMICAL METHOD FOR DETECTING AND STUDYING UNDERWATER VOLCANIC ACTIVITY

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 5, Sep-Oct 84 (manuscript received 7 Jun 83) pp 40-48

GAVRILENKO, G. M., Volcanology Institute, Far Eastern Scientific Center, USSR Academy of Sciences

[Abstract] Methods for observation of underwater volcanic activity are discussed. Studies of temperature heterogeneities in the sea water near underwater volcanoes represent a very effective method of recording and investigating underwater volcanic activity. Hydroacoustic research methods have been widely used. Hydrogas surveys, allowing not only determination of anomalous contents of dissolved gases in sea water, but also determination of the composition and relationships of gas components, and therefore the nature of the gases, have yielded good results. Several hydrochemical parameters of sea water have been tested during cruises of the research vessel "Vulkanolog" as indicators of underwater volcanic activity. In April and May 1979 the "Vulkanolog" undertook combined geological-geophysical studies in the neighborhood of the Kerdamec volcanic arc. Detailed acoustic and hydrochemical studies revealed the presence of a volcano at 30°41.5 S, 178°27.0 W. The hydrochemical method is most effective when used in combination with other chemical and physical research methods, including recording of underwater sounds and seismic studies. Figures 3, tables 1; references 32:

19 Russian, 13 Western.

[144-6508]

UDC: 551.214:543.27

CONTINUOUS HYDROGAS PROFILING OF VOLCANIC ZONE ON VIETNAMESE SHELF (METHODS FOR FINDING UNDERWATER VOLCANOES)

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 5, Sep-Oct 84 (manuscript received 13 Dec 82) pp 30-39

AVDEYKO, G. P., CHERTKOVA, L. V. and GUSEVA, V. I., Volcanology Institute, Far Eastern Scientific Center, USSR Academy of Sciences

[Abstract] On the 11th and 15th cruises of the research vessel "Vulkanolog," methodological work was performed on discrete sampling of dissolved gases along the coast of the Kuril Islands in volcanic areas, showing that the informative gases for a search for underwater volcanic zones are H<sub>2</sub>, CO<sub>2</sub> and CH<sub>4</sub>. The studies revealed that the relative quantities of dissolved gases in the water differ depending on the level of the water mass selected for study. Apparatus has been developed for continuous recording of dissolved gases. This apparatus was used along the coast of Vietnam to determine the possibility of using the method to seek underwater volcanoes, zones of thermal



water relief and young fractures. The results of continuous hydrogas profiling are outlined on a map of the area. Within the shelf zone of Vietnam the concentration of dissolved underwater gases varies from 67 to  $239.10^{-4}$  vol.%. The results of the studies made on the 13th cruise of the "Vulkanolog" along the coast of Vietnam indicate that the method of continuous recording of dissolved underwater volcanic gases is quite applicable for seeking out zones of manifestation of underwater volcanic activity. Zones of increased concentration and anomalies in the content of volcanic gases may result from nonvolcanic sources, as is the case in the northern portion of the area studied. The method of continuous hydrogas profiling is also applicable for the location of young faults. Since anomalies in underwater volcanic gas content may result from various causes, the method of continuous hydrogas profiling is useful in a search for underwater volcanoes only in combination with other geological and geophysical methods. Figures 7; references 14: 8 Russian, 6 Western.  
[144-6508]

UDC: 551.352:552.14

DIFFERENCE IN DEGREE OF COMPACTION OF SEDIMENTARY DEPOSITS ON CONTINENTS  
AND IN OCEANS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian  
No 10, Oct 84 (manuscript received 12 May 83) pp 85-93

BELOTSEKOVETS, Yu. I. and LOGVINENKO, N. V., Leningrad State University;  
Dnepropetrovsk Mining Institute

[Abstract] A study is made of the degree of compaction of oceanic sediments in comparison with sediments on the continents and the influence of the water column on compacting of oceanic sediments. A mechanical model of gravitational compaction of oceanic sediments is developed and compared with experimental data which indicate that the weight of the water column seems to have no "decompacting" influence on the underlying sediments. Incompletely compacted pelagic red clay is related to the great dispersion of particles, the slow sedimentation rates and loss of pore water and particularly the fact that over a long period of time the sediments were in the stage of incomplete diagenesis. This incomplete diagenesis is the major difference between oceanic and continental sediments. Figures 5, references 41: 24 Russian, 17 Western.  
[138-6508]

UDC: 553.98+551.24+551.7

SPECIFICS OF TECTONIC AND STRATIGRAPHIC DISTRIBUTION OF OIL- AND GAS-BEARING REEFS OF WORLD

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 278, No 6, Oct 84 (manuscript received 21 Dec 83) pp 1433-1438

KUZNETSOV, V. G., Moscow Petrochemical and Gas Industry Institute imeni I. M. Gubkin

[Abstract] Some 10 to 12% of hydrocarbon deposits in the capitalist and developing nations are concentrated in reefs. Deposits of oil and gas are known in reefs of varying tectonic structure. This article discusses the tectonic and stratigraphic distribution of oil- and gas-bearing reefs throughout the world. The maxima of oil and gas accumulation reached does not always correspond to periods of active reef formation in general. For example, the Devonian and Cretaceous-Miocene maxima coincide in general with times of broad developments of reefs, whereas the upper Permian peak of reserves coincides with a period of general depression in reef formation. In spite of the extensive development of reefs in the Late Triassic and Jurassic, their oil and gas content is quite modest. Tables 2; references: 2 Russian. [140-6508]

UDC: 550.93(K-Ar):551.76:552.321:551.242.24(265.53)

ABSOLUTE AGE OF INTRUSIVE ROCKS IN SEA OF OKHOTSK SUBMARINE RISES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 278, No 6, Oct 84 (manuscript received 18 Nov 83) pp 1426-1429

VASIL'YEV, B. I., PUTINTSEV, V. K. and RUBLEV, A. G., Pacific Ocean Oceanology Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok; All-Union Geology Scientific Research Institute, imeni A. P. Karpinskiy, Leningrad

[Abstract] In July and August of 1981 a geological-geophysical expedition of the Pacific Ocean Oceanology Institute and the All-Union Geology Scientific Research Institute on the research vessel "Kallisto" performed dredging on submarine rises in the Sea of Okhotsk, bringing up large numbers of large lumps of various granitoid rocks measuring up to 0.5 m in diameter. The size, shape and dredging conditions under which the rocks were brought up indicate that they are specimens of crustal intrusive rock. The age of the rock specimens was determined by the potassium-argon method. Interpretation of the results indicates that various minerals have varying ability to preserve radiogenic argon, so that agreement of measured ages of different minerals in a single sample indicate either the time of formation of the rock or the age of an intensive superimposed process. In the case of superimposed processes of moderate intensity, the measured ages based on minerals from a

single specimen form a sequence in the order of decreasing stability of the minerals to loss of argon. This is true only for thermal losses of argon. The regularities of distortion of measured ages by chemical transformations are not known. The data indicate varying manifestation of granitoid magmatism in the formation of geological structures of the seismoacoustic basement in the Sea of Okhotsk. As time passed, granitoid magmatism moved from the Kuril regions of the Sea of Okhotsk toward the continent, and its intensity increased from the Jurassic to the Late Cretaceous. Figures 1, tables 1; references: 1 Russian.  
[140-6508]

UDC: 550.344.097.7:551.14

#### INTERNAL WAVES IN LAYERS OF EARTH'S UPPER MANTLE

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZHANSKOY SSR, SERIYA NAUK O ZEMLE in Russian No 2, 1984 pp 98-104

GADZHIYEV, R. M. and KADIROV, F. A.

[Abstract] The amplitude of the vertical velocity component of a wave disturbance at a division boundary and free surface of a two-layer model of the upper mantle is determined for the case when the lower layer includes the main horizontal flow existing in a certain period of geological time. When there is horizontal flow in the lower layer of the two-layer model of the upper mantle, internal waves arise. Perceptible disturbances of the free surface are clearly manifested in a continental model. In the oceanic model, the free surface is very little disturbed, if at all. The length of the internal wave disturbing the free surface and its vertical velocity component are comparable with the lengths and amplitudes of waves at the earth's surface observed in secondary leveling data. With fixed values of the ratio of viscosities of the layers and time of existence of the horizontal flow, long internal waves have great amplitude. Analysis of the computation results shows that in the ocean model internal waves creating perceptible disturbances do not develop at the earth's surface. This is probably the major reason that the geological structure of the continents differs sharply from that of the oceans. Tables 1; references: 8 Russian.  
[132-6508]

UDC: 534.529

DETERMINATION OF GAS DIFFUSION COEFFICIENT IN SEA WATER BASED ON DISSOLVING OF AIR BUBBLES

Moscow AKUSTICHESKIY ZHURNAL in Russian No 4, Jul-Aug 84 (manuscript received 3 Feb 83) pp 455-459

GONCHAROV, V. K., KUZNETSOVA, S. N., NEUYMIN, G. G. [deceased] and SOROKINA, N. A., Marine Hydrophysics Institute, Ukrainian Academy of Sciences

[Abstract] In situ measurements of the diffusion coefficient of bubbles in sea water were made in the spring and summer in the Black Sea and Sea of Japan, both in the littoral zone and in the open sea. The instrument used was a vertical tubing section covered at both ends. It was rapidly inserted into the water with the end covers removed, forming air bubbles of various sizes. The covers were then closed and the bubbles rose and settled on the bottom surface of the top glass cover. The device was then lowered to a fixed depth and the bubbles photographed at uniform time intervals to determine their rate of dissolution or growth. Curves illustrate the relative radius of bubbles as they dissolve at various depths. An equation is presented which describes the dissolution of the bubbles as a function of depth. The calculated diffusion coefficient characterizes the properties of the sea water where the bubbles dissolved as well as the properties of the surface film separating the gas and liquid. The results indicate that the distribution of surface-active substances at shallow depths in the sea is quite irregular. Figures 3, tables 1; references 4: 3 Russian, 1 Western. [133-6508]

UDC: 551.464

SOUTH ATLANTIC BASALTS (BASED ON MATERIALS OF 7th CRUISE OF RESEARCH VESSEL 'PROFESSOR SHTOKMAN')

Moscow GEOKHIMIYA in Russian No 10, Oct 84 (manuscript received 18 Apr 83) pp 1400-1406

DMITRIYEV, L. V., KHARIN, G. S., SUSHCHEVSKAYA, N. M. and ZAPUNNYI, S. A., Geochemistry and Analytic Chemistry Institute, imeni V. I. Vernadskiy, USSR Academy of Sciences, Moscow; Atlantic Division, Oceanology Institute, USSR Academy of Sciences, Kaliningrad

[Abstract] On the 7th cruise of the research vessel "Professor Shtokman" 14 Feb-30 May 1982, crustal rock samples were collected along the southern branch of the mid-Atlantic ridge to supplement available information on the magmatism of this region. The combination of areas occupied by basalts of various types is of great interest in connection with the problem of formation of the oceans. One of the most important results of the expedition is the finding of hyperbasites raised by an impact coner and consisting of small

fragmented material in the form of thin layers in dense deep water sediment. This is essentially the first finding of ultrabasic rock in the South Atlantic. The results of the cruise showed that the distribution of basalts of type 2 (low depth) is similar to that in the North Atlantic. There is probably a comparatively narrow band, probably also young in age. The associated structure is a South Atlantic analogue of the Azores-Gibraltar structure in the north, though probably of different origin. Figures 3, tables 2; references 8: 4 Russian, 4 Western.  
[136-6508]

UDC: 551.464

#### DETERMINATION OF COPPER, LEAD AND CADMIUM IN OOZE WATERS OF CENTRAL PACIFIC

Moscow GEOKHIMIYA in Russian No 10, Oct 84 (manuscript received 24 Mar 83)  
pp 1517-1526

KOSOV, A. Ye. and DEMIDOVA, T. P., Oceanology Institute, USSR Academy of Sciences, Moscow

[Abstract] The process of formation of ferromanganese nodules, like all other physical and chemical processes in ocean sediments, occurs in the presence and with the participation of ooze water. The nodules consist primarily of elements present in sea water in microscopic quantities. The mechanism of their formation and growth is not yet known. Reliable studies of the content and the behavior of metals in ooze water are important for clarification of this mechanism. In this study the method of ion-scan potentiometry was used to determine the content of copper, lead and cadmium in ooze and ocean waters. Comparison of the results produced by this method and by atomic absorption spectrophotometry shows good agreement. The ooze water is in equilibrium with the sediment. Consequently, the source of large quantities of copper in ooze water is the sediment itself. If the concentration of metals is decreased by their sorption by nodules, the sediment attempts to restore the equilibrium by giving up an additional quantity of metal. The ooze water thus acts as a transport medium, supporting constant arrival of new matter for the growing nodules. Figures 6, tables 2; references 6: 3 Russian, 3 Western.  
[136-6508]



UDC: 553.31+551.465

#### NICKEL MINERALS IN FERROMANGANESE NODULES IN PACIFIC

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 278, No 4, Oct 84 (manuscript received 13 Feb 84) pp 958-961

BATURIN, G. N. and DUBINCHUK, V. T., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] New data are presented on the presence of independent nickel minerals in ferromanganese nodules. The material consisted of a group of nodules from the eastern tropical portion of the Pacific Ocean. Studies were performed on a transmission electron microscope with microdiffraction of particles on replicas and by microscopic x-ray spectral analysis. Most nodules were found to contain finely dispersed segregations of iron sulfides and nickel minerals. The nickel minerals were primarily in 4 classes: intermetallic compounds, oxides, arsenides and sulfides. The presence of these nickel minerals can be interpreted from the standpoint of cosmic, magmatic, hydrothermal or authigenic-diagenetic origin. None of these hypotheses has taken a leading position as yet due to the insufficient level of study of the properties of such nodules. The authors believe that the presence of the entire range of nickel minerals found may be related to the biogeochemical processes of conversion of organic matter, the flow of which to the bottom in the pelagic zone of the ocean is supported by an effective pellet transport mechanism. Figures 3, tables 1; references 15: 6 Russian, 9 Western.  
[141-6508]

UDC: 551.465

#### REACTION OF OCEAN-ATMOSPHERE SYSTEM TO FOREST DESTRUCTION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 278, No 4, Oct 84 (manuscript received 15 Mar 84) pp 979-982

KAGAN, B. A., RYABCHENKO, V. A. and SAFRAY, A. S., Leningrad Branch, Oceanology Institute, imeni P. P. Shirshov, USSR Academy of Sciences

[Abstract] At present rates of increase of forest destruction tropical zone forests may well disappear before the end of the next century. It is important to know the climatic results of this destruction. This article analyzes the results of destruction of all forest masses. Three versions are analyzed: 1) wood of forests burned, no new plantings made, soil humus not preserved; 2) wood burned, grass planted, soil humus not preserved; 3) wood burned, agricultural crops planted, humus preserved. Version 1) results in an increase in radiation balance of the surface and an increase in continental temperature, increasing evaporation and precipitation. Versions 2) and 3) cause opposite changes in all climatic characteristics except heat release



from the ocean into the atmosphere. Tables 1; references 6: 4 Russian, 2 Western.  
[141-6508]

UDC: 551.352

#### CRITICAL LEVELS OF CARBONATE ACCUMULATION IN INDIAN OCEAN

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 277, No 3, Jul 84  
(manuscript received 17 Jan 84) pp 652-655

BELYAYEVA, N. V. and BURMISTROVA, I. I., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] An attempt is made to trace the major trends in the behavior of all three critical levels of carbonate accumulation in the Indian Ocean and to analyze them, constructing a meridional cross section showing summary data on the critical depth of carbonate accumulation, foraminifera lysocline and carbonate lysocline for each latitude zone. The three depths are controlled by the productivity of organisms with carbonate skeletons and the conditions of preservation of skeletal remains on the bottom, primarily by the saturation of benthic water with dissolved calcium carbonate. The rates of arrival of terrigenous and biogenous carbonate materials at the bottom also play a significant role in the accumulation of carbonate material. The leading factor determining the composition and boundaries of propagation of carbonate sediments in the deep water areas of the ocean is the degree of dissolving activity of the water. The studies show the basic regularities of the relationship of depth of critical levels of carbonate accumulation to structure of the water and productivity of plankton in the Indian Ocean. Figures 1; references 15: 9 Russian, 6 Western.  
[148-6508]

UDC 553.2

#### ANCIENT REEFS AND LEAD-ZINC DEPOSITS (PROSPECTS IN EASTERN USSR)

Novosibirsk TIKHOOKEANSKAYA GEOLOGIYA in Russian No 6, Nov-Dec 84 (manuscript received 2 Apr 84) pp 58-64

SHCHEGLOV, A. D., KRASNOV, Ye. V. and RATKIN, V. V., Far Eastern Geology Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok

[Abstract] Zones of major faults are most favorable for the development of exceptionally dense populations of reef-forming organisms on the floor of shelf areas. The formation of structures of the barrier reef types occurs at the boundaries of subsiding tectonic blocks along deep faults extending

to the upper mantle. Such phenomena are manifested in the eastern regions of the USSR. The formation of reefs, development of deep faults and the accompanying genesis of lead-zinc ores can be regarded as paragenetically related processes, among which the development of zones of deep dislocations in relatively shallow-water marine basins situated along the periphery of or in the internal parts of major tectonic blocks with the penetration of ore-bearing thermal springs and thermal energy along the forming faults is the key factor in the formation of lead-zinc deposits. Under such geostructural circumstances reefs serve as indicators of the emergence of ore-bearing solutions on the sea floor and at the same time are favorable for the localization of ores by structural traps. With this taken into account, it is understandable why mineralization is associated with the breccias of marginal parts of paleoreef formations. One of the authors of this articles observed such phenomena in shore, barrier and atoll reefs on expeditions aboard the "Dmitriy Mendeleev" and "Kallisto" in the southwestern part of the Pacific Ocean. Formations of reef genesis in the eastern part of the USSR must be regarded as promising for the discovery of new lead-zinc and other deposits, primarily of the stratiform type. Figures 3; references 22: 16 Russian, 6 Western.  
[237-5303]

UDC 551.464(262.5)

#### SYNTHETIC SURFACE-ACTIVE SUBSTANCES AT SEA WATER - ATMOSPHERE INTERFACE

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR. SERIYA B: GEOLOGICHESKIYE, KHIMICHESKIYE I BIOLOGICHESKIYE NAUKI in Russian No 11, Nov 84 (manuscript received 9 Apr 84) pp 3-5

BULGAKOV, N. P., corresponding member, Ukrainian Academy of Sciences, SHEREMET'YEVA, A. I. and SHUMCHENKO, O. A., Marine Hydrophysics Institute, Ukrainian Academy of Sciences, Sevastopol

[Abstract] A study was made of the content, distribution and diurnal variation of the concentration of synthetic surface-active substances (SSAS) in the coastal waters of the Black Sea from an oceanographic platform located at a depth of 35 m 600 m from the shore. The enrichment of the surface microlayer (SML) with SSAS (for the season on the average sixfold) is evidently attributable to the characteristics of the molecular structure of the water at the water-atmosphere interface. An excess surface energy arises which is manifested in an anomalously high surface tension for water in comparison with fluids of similar structure. The thermodynamically most advantageous processes are those leading to a decrease in surface tension. The positive adsorption of SSAS at the water surface gives precisely such an effect. The maximum content of SSAS in the SML and 1-m layer is during the daytime and the minimum is at nighttime. The typical picture of the mean daily dynamics of SSAS changes sharply with an increase in wind velocity of 6-8 m/sec. A special study was made to clarify the dependence of SSAS concentration on wind velocity, as well as the dependence of film elasticity on the

SSAS concentration and on wind velocity. There was a direct correlation between the SSAS concentration and elasticity in the range of measured concentrations. The quantity of SSAS in the SML, like the film elasticity in the coastal waters of the Black Sea, is unambiguously dependent on wind velocity, associated with the mechanism of formation and destruction of the SML. Figures 3; references 4: 3 Russian, 1 Western.  
[187-5303]

UDC 551.465.41(262.5)

## FORMATION OF COLD INTERMEDIATE LAYER IN BLACK SEA

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 279, No 4, Dec 84  
(manuscript received 3 May 84) pp 986-989

OVCHINNIKOV, I. M. and POPOV, Yu. I., Southern Branch, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences; Odessa Branch, State Oceanographic Institute

[Abstract] The cold intermediate layer in the Black Sea, with a temperature  $6.5-7.5^{\circ}$  at depths 25-150 m, has a highly important role in forming the hydrological, hydrochemical and biological characteristics of the basin. It is known that the cold intermediate waters are a result of winter convective mixing, but the centers of their generation and the process of formation of these waters have remained unclear. These matters were investigated during a hydrological survey of the eastern Black Sea on the research ship "Ya. Gakkel'" during the period 11-22 March 1983. It was found that the principal centers of formation of these cold intermediate waters are at the centers of cyclonic circulations. The winter circulation in these circulations and then the density currents descending along the dome of the pycnocline are the principal sources of replenishment and renewal of the cold intermediate layer. The process of formation of this water mass therefore has a very local and brief nature (spatial and temporal scales of several tens of miles and several days). The cold intermediate layer lies in the upper part of the pycnocline and therefore is highly stable, but being closely related to the dynamics of the pycnocline it loses stability of its properties in divergence and convergence zones. Transformation of its properties is clearly manifested in winter at the centers of cyclonic circulations. Intensive interaction between the oxygen and hydrogen sulfide zones in winter occurs over an area of about  $50,000 \text{ km}^2$  tied in to the centers of the two main cyclonic circulations. Figures 1; references 8: 7 Russian, 1 Western.  
[201-5303]

UDC 621.391.32

SINGLE-WIRE LINE WITH INDUCTIVE EXCITATION FOR OCEANOLOGICAL MEASUREMENTS

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript received 6 Jan 83, after revision 10 May 83) pp 1031-1034

PROKHOROV, V. Ye., All-Union Scientific Research Institute of Physical Technical and Radio Engineering Measurements, Mendeleyevo

[Abstract] It is important to analyze the characteristics of single-wire communication lines because they are of exceptional values for freely sliding probes and noncontact telemetric systems. The transmission of signals in single-wire lines is determined by the electromagnetic properties of a three-layer system consisting of a conducting medium, current-carrying strand and insulating covering. Although the principles of the theory of such systems have been developed, little has been published on the use of single-wire lines in an inductive excitation regime. Precisely such a regime makes it possible to ensure noncontact communication with submersible measurement instruments. This article gives an analysis of the behavior of the amplitude-frequency characteristic and clarifies certain aspects of use of a sea single-wire inductive communication line which must be taken into account in practical work. It is shown that with excitation by a current generator a system with a single-wire communication line has an optimum communication frequency. Theoretical and experimental computation expressions and practical recommendations are given which can be used in developing freely sliding probes and noncontact hydrophysical instruments. Figures 4; references 9: 7 Russian, 2 Western.  
[215-5303]

UDC 551.46.01

MPM-5M SEA MAGNETOMETER

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript received 30 Mar 83, after revision 1 Jun 83) pp 1022-1026

AFONYASHIN, A. A., BELYAYEV, I. I., BELYAYEVA, Ye. N., NERONOV, B. N., PARAMONOV, A. A., POPOV, E. A. and FILIN, A. M., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] The MPM-5 sea proton magnetometer, developed at the Oceanology Institute, was described in OKEANOLOGIYA, Vol 19, No 1, pp 178-180, 1979. Although it yielded good results, it has been replaced by the modified MPM-5M, which has been used since 1981 on all the institute's ships making geomagnetic measurements. It has a "fish" of a new design and a sensor of a toroidal configuration, there is a new quartz clock for registry of current time and the number of the day and a unit for linkup with a puncher for digital registry of information on the geomagnetic field and time. A

distinguishing feature is a high response (0.1 nT) in all measurement cycles from 1 to 60 sec, with output of data to the system for the collection of geophysical data. The range of the measured field is 20-70  $\mu$ T. The standard deviation of the measurement results is not more than  $\pm 1.0$  nT. The operating regime is automatic with cycles 1, 3, 5, 20 and 60 sec (manual operation is also possible). Data are read from a display in the form of a 6-digit decimal number in nT, but also in analog and digital form. Current supply is  $\sim 220$  V, 50 Hz. Required power is not more than 300 V $\cdot$ A. The magnetometer weight without the towing cable is 65 kg. Successful measurements have been made over the mid-oceanic ridges, in test ranges and along the ship's track. Work was done in the equatorial and high latitudes where the signal-to-noise ratios were 8-15 and 20-40 respectively. Experience has shown that it is highly reliable and convenient to use. Figures 4, tables 2; references: 2 Russian.  
[215-5303]

UDC 551.46.08

#### MEASUREMENTS OF SEA LEVEL TIDAL FLUCTUATIONS BY HYDROSTATIC METHOD

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript received 30 Dec 81, after revision 1 Nov 83) pp 1009-1012

AKULICHEV, V. A. and IL'IN, A. K., Pacific Ocean Oceanological Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok

[Abstract] The ordinary system of tide gages is easily made nonfunctional by storms or typhoons. This dictates development of an alternative, less vulnerable method for measuring tidal fluctuations. The authors propose a hydrostatic method for this purpose which is based on a change in gas pressure with a change in level. Several variants are proposed. In both the gas in the upper part of the measurement tube is in a rarefied state, not under excess pressure. This makes it possible to make measurements without additional instrumentation (extremely important under expeditionary conditions in remote regions). The measurement tube, of a small diameter, has its lower end submerged in the sea and is filled with a degassed fluid, such as glycerine or water. Attached to the lower end of the tube is a small chamber with a flexible wall. The flexible wall of the detector transmits the hydrostatic pressure and also compensates the very small temperature variations of the fluid in the tube. Very pure rubber is used as the flexible wall, which can move freely in the required range without the appearance of elastic stresses. A diagram of the instrument and a diagram of installation of the measurement system accompany the text and are used in explaining the theoretical principles and practical operating conditions for this hydrostatic measurement complex. Measurement error is 0.5-1.0%. The recording instrument is on shore. Stormy weather causes no malfunctions. Figures 2; references: 4 Russian.  
[215-5303]



UDC 595.34

INTRA-ANNUAL VARIABILITY OF NUMBER OF COPEPODA SPECIES IN OCEANIC COMMUNITIES

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript received 7 Feb 83) pp 999-1002

GEYNRIKH, A. K., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] The Soviet and foreign literature was exploited in this comparison of the variability of the number of Copepoda throughout the year in the Sargasso and Norwegian Seas and the polar basin, whose populations are characteristic for tropical, Atlantic boreal and high-arctic oceanic communities. In the Norwegian Sea and in the polar basin the variations in the number of Copepoda are to a considerable degree seasonal, whereas in the Sargasso Sea some species possibly do not have an annual period. It was found that the intra-annual variability of the number of Copepoda, both with allowance for their entire range of distribution and within the limits of the upper 500 m, does not differ significantly for the northern margin of the tropical oceanic community and the Atlantic boreal community and probably is close to that in other oceanic tropical regions. The variability of the species within the limits of the entire range of their vertical distribution in the boreal and high-arctic communities also does not differ significantly. The variation in number are not dependent on the seasonal amplitude of water temperature variations. The reason for the close variability in the number of Copepoda is the presence in all regions of Copepoda with two main types of development: species oriented on intermittent and constant food resources. The greatest number belong to the latter group. Species of this group have relatively short generations and reproduce all or almost the entire year; their populations always have members of different age and easily change in number under the influence of various physical and biological factors. The species oriented on intermittent food resources have considerably longer generations and at any moment in time one or two age stages dominate. Reproduction and a considerable increase in numbers occur during a short period of the year. In arctic boreal regions these are the dominant species; variations in their number correlate with the spring production of photoplankton, whereas in the tropical regions these are species whose number increases sharply during the period of unwell of waters. Figures 1, tables 1; references 8: 3 Russian, 5 Western.

[215-5303]



UDC 551.475:591.13(265.1)

TROPHIC RELATIONSHIPS IN PLANKTON COMMUNITIES IN PACIFIC OCEAN TROPICAL  
REGIONS OF DIFFERENT PRODUCTIVITY

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript  
received 1 Aug 83, after revision 13 Dec 83) pp 986-993

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[Abstract] Field data for a quantitative evaluation of trophic relationships in plankton communities in the epipelagic region were controlled at 130 stations in the Pacific Ocean on biological expeditions of the Oceanology Institute. Major ecological groups (elements) were defined in the studied plankton associations populating regions of different productivity, as criteria using the size, taxonomic and trophic characteristics of the mass species. The field data were supplemented by model computations and data in the literature. The data are examined separately for hypertrophic, eutrophic, mesotrophic and oligotrophic waters. It was found that transition from more productive waters to less productive waters is accompanied by a distinct restructuring of the structural-functional characteristics. In the total biomass of plankton there is a decrease in the fraction of phytoplankton, an increase in the numbers of bacteria and mesozooplankton. The size composition changes, as well as the trophic relationships. There is a considerable decrease in the role of phytoplankton in the ration of all zooplankton and an increase in the role of bacteria, protozoa and mesozooplankton. The feeding conditions for nanophages and to a lesser extent, for euryphages, worsen. Virtually everywhere the food supplies of predators are entirely adequate. The findings from this study are entirely consistent with data published elsewhere in the literature. Tables 5; references 21: 20 Russian, 1 Western. [215-5303]

HYDROCHEMICAL ASPECTS OF PRODUCTION CYCLE ON NORTHEASTERN SHELF OF UNITED  
STATES

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript received  
29 Nov 82) pp 977-985

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[Abstract] During the periods February-May and August-November 1978 Soviet-American expeditions aboard the "Argus" and "Belogorsk," working under the MARMAP program, collected materials including the results of simultaneous determination of the concentration of biogens, chlorophyll, primary production, species and size composition of phytoplankton. These detailed data have made it possible to analyze the dynamics and interrelationship of the indices of mineral nutrition and the process of primary bioproduction for

clarification of the regional and seasonal patterns of the production cycle, matters virtually not touched upon in articles published by such American authors as Cohen, Mandelli, Pastuzak, Rilley and Thomas, devoted to individual aspects of the production process in individual regions, especially Georges Bank. The author has used these data, averaged for four regions and seven periods, in an analysis of the characteristics of the annual production cycle and the main features of the interrelationship between chemical and biological processes in each of the regions. The detailed materials presented show that with respect to chlorophyll content, the production cycle had a two-peak character, as is typical for temperate waters. Two types of primary production were defined: quasistationary ( $1-2 \text{ gC} \cdot \text{m}^{-2} \cdot \text{day}^{-1}$ ) and with a well-expressed spring-summer maximum (up to  $5 \text{ gC} \cdot \text{m}^{-2} \cdot \text{day}^{-1}$ ). The numerical values of the seasonal dynamics of the content of mineral forms of biogens in the photic layer and the phytoplankton production cycle changes inversely proportionally to one another in the spring and autumn, but in summer independently of one another. A high production level in the period of the summer minimum of biogens and the biomass of algae was ensured primarily by a dominance of flagellates in the phytoplankton community. Figures 2; references 15: 4 Russian, 11 Western.  
[215-5303]

UDC 551.462(268)

## HYDROTHERMAL BARITE ENCRUSTATIONS ON BASALTS IN ATLANTIS II DEPRESSION (RED SEA)

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript received 14 Jul 83) pp 954-959

SVAL'NOV, V. N., STRIZHOV, V. P., BOGDANOV, Yu. A. and ISAYEVA, A. B.,  
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[Abstract] About 50 kg of thin-layered barite formations were raised on ship-board during the 3d cruise of the "Professor Shtokman" during dredging of the slope of the central rise of the Atlantis II depression in the Red Sea. The material was dredged from depths 2,060-2,020 m. The Atlantis II depression is in the axial part of the actively developing Red Sea rift. Spreading and forming of a new oceanic crust in the rift zone is accompanied by hydrothermal activity. The mentioned barite ore (with a sphalerite admixture), judging from its geological position, textural, mineral and chemical characteristics, as well as the isotopic composition of sulfur and oxygen, is of hydrothermal origin. It evidently was formed near the mouth of a hydrothermal vent with an intermittent regime as a result of the chemogenic precipitation of barite on cooled basalts. The increased content of Sr, Zn and Cu in barite encrustations may also indicate a hydrothermal origin. It is also clear that the sulfate in sea water is not the primary source of sulfur in the barite. A model of the formation of the barite bodies is proposed. The sea waters or hot bottom brines circulating through fissures in the upper part of the Red Sea rift crust interact with the basalts. The temperature

of the brines (due to the high heat flow) can exceed 300°C. The suppliers of sulfate sulfur, transported to the bottom surface by hydrotherms, may be Red Sea water, the evaporite layer responsible for formation of the bottom brines and basalt. The sulfide sulfur of these hydrotherms is leached from the basalts, but may be formed in part by reduction of sulfate sulfur. The accumulation of barite may still be continuing. Figures 2, tables 3; references 9: 5 Russian, 4 Western.  
[215-5303]

UDC 551.462(268.5)

#### BOTTOM GEOMORPHOLOGY OF WESTERN PART OF EAST SIBERIAN SEA

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript received 15 Mar 83, after revision 11 May 83) pp 948-953

NIKIFOROV, S. L., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] The Novosibirskiye Islands and the adjacent shelf, highly inaccessible and poorly studied, were investigated in 1981 and new data were obtained on the geomorphological structure of the coastal part of the shelf. The East Siberian Sea is a typical marginal shelf sea with shallow depths and small slopes not exceeding 0.0003. One of the main features is the presence of a great number of narrow ridges, for the most part with a submeridional orientation, developed to depths of 30 m. These ridges, complicating the level relief of the upper part of the shelf, are mostly along the eastern and southeastern shores of the islands. In large part they duplicate the configuration of the shores of these islands, are up to 60 km from the shore and have an extent up to 150 km. These ridges were thoroughly studied. It is concluded that there was an inherited development of these accumulative shore forms during the post-Pleistocene period. The structural importance is that they mark major buried anticlinal and brachyanticlinal folds whose arches are associated with the island landmass of the western part of the East Siberian Sea. Taking into account the presence of seven series of submarine bars it appears that during the regression period there was the same number of stages in temporary stabilization of level. Several types of shelf relief were defined: flat accumulative plain of recent and Pleistocene wave accumulation; major accumulative forms of the bar type; accumulative-denudational relief of edges of structural depression; subhorizontal accumulative plain of recent and Pleistocene wave accumulation of the structural depression floor; accumulative-deformational relief of sides of Indigirka River paleovalley; accumulative-denudational relief of Sannikov and Dmitriy Laptev Straits. Figures 2; references: 7 Russian.  
[215-5303]

UDC 551.465.(265.1)

MORPHOMETRIC CHARACTERISTICS OF WALVIS AND NAZCA BLOCK-VOLCANIC RIDGES

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript received 25 Feb 83) pp 929-935

ZAKHAROV, L. A., RUDENKO, M. V. and SOLDATOV, A. V., "Zaprybpromrazvedka" Administration of Fishery Reconnaissance and the Scientific Research Fleet of the Western Basin, Kaliningrad; Atlantic Branch, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Kaliningrad

[Abstract] Data collected by the "Akademik Kurchatov" and various vessels of the fishery reconnaissance fleet were used in computing the four principal morphometric parameters of Walvis and Nazca Ridges (horizontal and vertical dissection, mean depth level and slopes). Bathymetric charts of these two ridges, which have many geomorphological features in common, are presented. Differences in the morphological characteristics of some macroblocks in these ridges, however, indicate a geological-tectonic nonuniformity of these ridges. The morphometric parameters of Walvis Ridge and Nazca Ridge in some cases are distinctly different. The Nazca Ridge differs from the Walvis Ridge in having a greater mean depth level, lesser vertical and horizontal dissection. The principal difference between the ridges is a sharp differentiation of their morphometric characteristics in the macroblocks nearest the continents. The northeastern end of Walvis Ridge is characterized by a minimum mean depth, maximum mean slopes and maximum vertical dissection. The near-continent macroblock of the Nazca Ridge has directly opposite characteristics: deepest subsidence, minimum mean slopes and minimum vertical dissection for the entire ridge. This difference is attributable to the fact that there is a subduction zone along the west coast of South America and no such zone along the shores of West Africa. Figures 3; tables 1; references 12: 7 Russian, 5 Western.  
[215-5303]

UDC 551.462.6

FRactal GEOMETRY: QUANTITATIVE DESCRIPTION OF OCEAN BOTTOM RELIEF

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript received 19 Jul 83, after revision 24 Oct 83) pp 924-928

RARENBLATT, G. I., ZHIVAGO, A. V., NEPROCHNOV, Yu. P. and OSTROVSKIY, A. A., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] So-called fractal geometry (V. V. Mandelbrot, THE FRACTAL GEOMETRY OF NATURE, San Francisco, 1982) can be used as a quantitative description of sea floor dissection. This is illustrated in the example of a long (2,889 km) profile of the ocean floor of a sublatitudinal strike obtained in 1981 on the first cruise of the "Akademik Mstislav Keldysh." This profile



intersected the Mid-Atlantic Ridge in the region  $21^{\circ}30'N$ . It was found that there is a regular decrease in the fractal dimensionality with increasing distance from the axis of the mid-oceanic ridge, evidently being a result of smoothing of the bottom due to the action of bottom currents and sedimentation processes. It is shown that introduction of fractal dimensionality  $D$  will make possible the clearer regionalization of the ocean floor on the basis of geomorphological criteria. The patterns of variability of  $D$  can be related to tectonic processes, sedimentation and other manifestations of endogenous and exogenous forces on the ocean floor. It is proposed that this method will make it possible to obtain more specific data on relief of the ocean floor and the acoustic basement and will help in revealing new patterns relating to the dependence of fractal parameters on bottom age and various physical processes in different ocean regions. Figures 4; references 5: 2 Russian, 3 Western.  
[215-5303]

UDC 550.42:546.18:551.352.2

#### DEPENDENCE OF PHOSPHORUS CONTENT ON CARBONATE CONTENT IN BOTTOM DEPOSITS

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript received 22 Jun 82, after revision 10 Mar 83) pp 910-915

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[Abstract] A detailed study of the ratio of P and  $CaCO_3$  contents in abyssal sediments was made using data collected on 6 cruises of the "Vityaz'" in the Indian Ocean. In the surface layer of deposits with a significant or predominant calcareous component (109 samples) ordinary criteria were used in defining four types of sediments: hemipelagic clays  $10\% < CaCO_3 < 50\%$ , hemipelagic marly oozes  $50\% < CaCO_3 < 75\%$ , foraminiferic oozes  $> 75\% CaCO_3$ , foraminiferic-coccolithic oozes  $> 75\% CaCO_3$ . It was found that different types of bottom deposits as defined above are characterized by statistically stable mean phosphorus contents. An inverse dependence of P and  $CaCO_3$  is manifested very weakly in both oceanic and marine sediments with a considerable scatter of P and  $CaCO_3$  values. Biogenous calcareous matter is the source of the phosphorus. The finely dispersed coccolithic phase is considerably enriched with P. When P contents are scaled to the carbonate-free residue there is a distortion of the peculiarities of behavior of phosphorus in early diagenesis processes and its relationship to the sources and element concentrators is lost. Anomalously high  $P_{cf}$  ( $P_{\text{carbonate-free}}$ ) and high-carbonate ooze values are attributable to the mathematical properties of the scaling formula, irrespective of the mineralogical composition of the carbonate-free residue of bottom deposits. Figures 2, tables 4; references 15: 13 Russian, 2 Western.  
[215-5303]

UDC 551.465.16(261)

#### SURFACE WATER MASSES IN TROPICAL ATLANTIC

Moscow OKEANOLOGIYA in Russian Vol 24, No 6, Nov-Dec 84 (manuscript received 14 Dec 81, after revision 15 Feb 84) pp 880-888

DUBRAVIN, V. F. and NAVROTSKAYA, S. Ye., Kaliningrad Technical Institute of the Fishing Industry and Economy; Atlantic Branch, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Kaliningrad

[Abstract] At present there is no unanimity in defining surface water masses in the tropical Atlantic. Much information has been accumulated during the last 30 years and this has been exploited in compiling maps of the percentage content of southern and northern tropical water masses in winter and summer. In the northern hemisphere use was made of the T,S indices of the equatorial and north tropical water masses and deep North Atlantic water mass. The 50% content line separates the tropical water masses from the surrounding waters. The tropical water masses occupy the main area of the central Atlantic; the equatorial waters are adjacent to the coasts of the continents. In the southern hemisphere there are a number of secondary water masses: waters of coastal upwelling along west coast of Africa; cold waters of Falkland Current; Bengal water mass. In the northern hemisphere there are two secondary water masses: waters of the Labrador Current and waters of the Canaries Current. The principal water masses in the region from 30°S to 40°N are tropical (northern and southern) and equatorial (western and eastern). The pattern of isolines of equal percentage content of tropical water masses indicates that the transformation of the centers of the main water masses occurs more rapidly along a meridian than along a parallel, especially in the direction of the high latitudes. The position of the boundaries of the water masses and their centers is associated with the atmospheric Trades circulation and its seasonal variability. Figures 4; references 13: 9 Russian, 4 Western.  
[215-5303]

UDC 622.271.5:551.462.66(265.53)

#### RESULTS OF SEA OF OKHOTSK FLOOR DREDGING

Moscow SOVETSKAYA GEOLOGIYA in Russian No 12, Dec 84 pp 100-106

VASIL'YEV, B. I., Pacific Ocean Oceanological Institute, Far Eastern Scientific Center, USSR Academy of Sciences; PUTINTSEV, V. K., MARKOVSKIY, B. A., SVYATOGOROVA, N. N. and SELIVANOV, V. A., All-Union Geology Scientific Research Institute, and UDINTSEV, G. B., Earth Physics Institute, USSR Academy of Sciences

[Abstract] Outcrops of the seismoacoustic basement were studied on a geological-geophysical expedition (15th cruise of the "Kallisto") in the



Sea of Okhotsk in 1981. Dredged samples were recovered from the South Okhotsk Basin, Deryugin Depression, Academy of Sciences and Institute of Oceanology Rises, a number of banks and the southeastern part of the Okhotsk Arch; all dredging stations, whose precise geographical positions were pinpointed with the assistance of a satellite navigation system, are listed in a table. The nature of the sampled material from each of these formations is discussed. The closeness of composition of rock-gravel material recovered at different stations and the large angular blocks and detritus raised to the surface at the same locations indicates a primarily local origin of the rock material and insignificant transport. At certain stations the rock material evidently is split off from the bedrock. The rock material is primarily magmatic, both intrusive, primarily granitoid, and effusive, and sedimentary. Among the raised rocks metamorphic rocks constitute a relatively smaller percentage. The evidences of stable combined presence of rocks of different composition and the observed discreteness of occurrence make it possible to discriminate definite structural-mineralogical associations of rocks and facilitate interpretation of structure of the seismoacoustic basement of underwater rises in the Sea of Okhotsk and the history of their formation. Figures 1, tables 3. [205-5303]

FISH RESOURCES STUDIES WITH SUBMERSIBLE 'SEVER-2' IN NORTHERN SEAS

Moscow GUDOK in Russian 5 Jan 85 p 4

LOGINOV, A., Murmansk

[Abstract] The article records a conversation with candidate of technical sciences Mikhail L'vovich Zaferman, head of the underwater research laboratory of the Polar Scientific Research Institute of Marine Fishing Industry and Oceanography (PINRO).

Zaferman commented on the use of manned submersible craft in fishing operations and the prospecting of new fishing grounds in northern seas. He related that in 1984 fish resources in an area of the North Atlantic were prospected with the aid of a special submersible, the "Sever-2", which had been sent from southern seas. This vessel is made of superstrong steel and possesses other features which enable its crew to conduct observations at depths of more than 2,000 meters. These features include streamlining with contours which preclude overloads on the craft's body. The "Sever-2" is equipped with a unit which ensures regeneration and normal pressure of the air inside the craft, and with other life-support systems. Scientists without special training can take part in underwater observations inside the "Sever-2", according to Zaferman.

Towed submersibles of the "Tetis" type, whose cost is relatively low, are now much in demand in the fishing industry, according to Zaferman. He reported that a "Tetis" craft is now being used in northern seas for observations in support of fishing expeditions. One of the developers of the "Tetis", Leonid Ivanovich Serebrov, is now working in PINRO's underwater research laboratory.

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TERRESTRIAL GEOPHYSICS

DISCOVERY FROM MODELING OF SILICATE CRYSTALLOGRAPHY DEEP IN EARTH

Moscow IZVESTIYA in Russian 21 Dec 84 p 3

[Article by I. Novodvorskiy]

[Text] On 20 December 1984, the USSR State Committee on Inventions and Discoveries recorded a discovery made by doctors of geological-mineralogical sciences V. Frank-Kamenetskiy and N. Kotov and candidate of geological-mineralogical Sciences E. Goylo, scientists of Leningrad University, and by their Moscow colleague, academician N. Belov.

Silicon is second only to oxygen with respect to their content in the Earth's crust. Silicon in it is found primarily in the form of silicon salts, so-called silicate minerals. In places they lie at great depths, as deep as several tens of kilometers. There, under the effects of high pressures and temperatures, crystals of silicate minerals change in form, reacting chemically with other salts which previously had become saturated with sea water, and also with moisture which has remained in pores of rock.

Man has not been able to penetrate to such depths. Even superdeep drilling is too shallow here. All that is left is to model the Earth's depths in the laboratory, which modern science is quite capable of doing. The Leningrad geochemists built a unit in which the necessary conditions were created: a pressure as great as 10,000 atmospheres, and a temperature as high as 600°C. Using advanced methods they established that in chemical reactions which take place at great depths, tiny crystals of silicate minerals do not decompose into separate ions and atoms. On the contrary, whole groups of ions and atoms form something like brick-blocks which, remaining unchanged, make a transition from one crystalline structure to another.

The discovery has made it possible to understand many deep-level geological processes in a new way. In addition, it has led to the development of new technologies of directed synthesis of certain crystals under high pressures and temperatures.

CSO: 1865/191

## GEOLOGICAL PROSPECTING WORK: NEW EQUIPMENT, PROCESSES

Moscow ECOTASS in English No 33, 3 Sep 84 p 2

[Text] The Soviet Union is working to develop and put into service new methods and promising techniques, modern high-efficiency technical systems and advanced processes of in-depth geological exploration. Prospecting equipment is built by 25 industrial ministries and 20 plants of the USSR Ministry of Geology. The list of prospecting equipment and systems consists of a total of more than 5,000 items.

Twenty-seven institutions and six design organizations develop more than 100 items of prospecting equipment every year. The level of their efficiency will be seen from the fact that more than 70 percent of their development projects reach the stage of actual realization. Many of their products and processes are of a decisive importance for speeding up scientific and technical progress. These include: "Gorizont" program-controlled multichannel seismic prospecting station, electrically-powered complex for driving prospecting workings, drill rig with a hydraulic core transportation system, and others. The scale of introduction of new equipment and advanced processes into prospecting is growing. They constitute one of the major factors for the intensification of work.

Geologists are assisted in their efforts by a wide range of new promising methods and technologies as well as technical systems for regional exploration, geophysical and prospecting work, drilling operations, laboratory studies and hydrogeological surveying. The list of new products and processes includes aerial and space photography, the use of multichannel digital seismic prospecting complexes complete with automatic data processing facilities, nonexplosive sources of elastic vibrations, physical and nuclear physical methods for the study of the composition of minerals, complexes of technical systems for drilling holes with periodic or continuous transportation of core, etc.

The Soviet Union has begun in-depth geological study of the earth with the help of superdeep holes.

Soviet geologists face challenging tasks in the exploration of mineral resources of the seas and oceans. For this purpose the Soviet shipbuilding industry has built research ships equipped with the newest types of geophysical, navigation and prospecting instruments and equipment.

Soviet marine geologists are now assisted by high-accuracy satellite navigation, deepwater photoprofiling and seismo-acoustics, seabed sample recovery from depths of five to six kilometers and some other types of prospecting.

Advanced equipment and processes play a leading role in tackling the tasks of prospecting for minerals at all phases of work.

In deep-well drilling for oil and gas geologists make use of roller-cutter drilling bits complete with hermetically-sealed oil-filled bearings, washing fluids with a low content of solid phase, drilling bits and cutting-type drilling bits faced with super-hard materials.

The use of new technical systems and advanced processes with periodic and continuous core recovery, fullcore drilling, vibratory-percussion drilling made it possible to raise drilling speeds 50 percent. The quality of geological information vastly improved. Domestic industry meets in full the demand of prospectors for high-efficiency drilling rigs, rock-crushing tools, control and measurement instruments, and different auxiliary devices which make it possible to drill wells with a high degree of efficiency and quality under very complex geological conditions.

The level of mechanization of geological prospecting now stands at 98 percent. Prospectors are using small-sized rock-loading machines, electric locomotives and other types of equipment.

One of the main areas of effort to speed up scientific and technological progress in geological prospecting is large-scale automation of processes on the basis of the use of automatic drilling rigs, standard prospecting equipment, robot complexes and computer facilities.

Samples of modern prospecting equipment were shown at the "GEOEXPO-84" international exhibition. The Soviet section showed the achievements of the Soviet Union in geological cartography, prospecting for and evaluating of mineral reserves, geophysical devices and instruments, new efficient techniques and systems for the analytical study of minerals. The Soviet Union also showed new drilling and mining equipment, efficient methods for the study of minerals at the laboratory and in the field.

A very interesting aspect of the Soviet section at the "GEOEXPO-84" international exhibition was that it demonstrated new geological areas in the study and exploration of the earth: aerospace and marine geology, and the use of mathematical methods and computers.

CSO: 1865/149

## INTERNATIONAL TIES OF SOVIET GEOLOGISTS

Moscow ECOTASS in English No 33, 3 Sep 84 pp 14-17

[Text] The USSR Ministry of Geology is taking an active part in the expansion and consolidation on a mutually advantageous and equitable basis of international economic, scientific and technical ties in the sphere of geology.

In the past three decades technical assistance in geological prospecting, the drawing up of long-term programs of geological prospecting, the organization and technical equipment of national geological services and the training of the personnel has been rendered to 52 foreign countries.

The Soviet Union first started cooperation in geology in 1931 with the Mongolian People's Republic. After the setting up of the Council for Mutual Economic Assistance (CEMA) in 1949, the relations of Soviet geologists with their colleagues from socialist countries began to develop rapidly. The 1950's and the 1960's witnessed the deepening and expansion of ties between the USSR and developing countries in the sphere of geology.

About 60,000 Soviet specialists have been dispatched for rendering technical assistance to foreign countries at the request of their national geological services since 1949. The volume of works, deliveries and services within the framework of technical assistance to foreign countries in the exploration of the mineral resources is growing at a rapid pace. With this in view various geological, geophysical, metallogenic, tectonic, hydrogeological, engineering-geological maps and material drawn up by Soviet specialists have been handed over to socialist and developing countries.

At present, about 4,000 Soviet specialists are working in 28 countries. They are rendering assistance in the exploration of mineral resources to Bulgaria, Hungary, Vietnam, Poland, Mongolia, the GDR, Czechoslovakia, Cuba, Yugoslavia, Algeria, Afghanistan, Angola, Ethiopia, Mali, Morocco, Laos, Mozambique and a number of other countries.

Operations performed abroad with the participation of Soviet specialists are rather varied. These include, for instance, regional geological and geophysical prospecting, the search for mineral deposits, the evaluation of the reserves of mineral deposits, the study of the composition and the technology of ores, the preparation of mineral deposits for exploitation, the consolidation of the base of existing mineral enterprises and oil fields. All these



operations include up-to-date methods of research with the utilization of modern technology, machinery and instruments and cover practically all the types of geological prospecting, including deep drilling and the driving of underground workings.

In the past 5 years alone over 250 oil and gas fields, the deposits of coal, ores of ferrous, nonferrous, rare-earth and noble metals, agrochemical and building raw materials, as well as underground waters have been discovered, explored and revalued abroad with Soviet technical assistance. On the basis of these deposits, as well as other deposits discovered earlier with the participation of Soviet geologists, mining and metallurgical enterprises, oil and gas extracting areas, plants to produce agrochemical raw materials and building materials have been built and are now functioning, while others are being designed.

The USSR has especially close ties in the sphere of geology with the CEMA member countries.

Exercising multilateral and bilateral cooperation with the geological services of the socialist countries, the USSR Ministry of Geology is taking part in the coordination of 5-year economic development plans, in the implementation of the comprehensive program of a further deepening and improvement of cooperation and the development of socialist economic integration of the CEMA member countries for the main types of energy, fuel and raw materials for the period ending in 1990.

The insuring of long-term supply of the national economies of the CEMA member countries with the reserves of the mineral raw materials is a major task set by the comprehensive program. With this in view, the USSR Ministry of Geology is taking an active part in multilateral agreements on the creation of the International Geological Expedition to Mongolia, on cooperation in intensifying geological prospecting on the territories of the Republic of Cuba and the Socialist Republic of Vietnam. With the active participation of Soviet specialists the fluorite deposits of Served and Khulyp-Kholbo and the compound molybdenum-tungsten deposit Tsidur-Tsagap were discovered in Mongolia, and the promising areas for fluorite, rare-earth metals and compound metal ores were prospected. In Cuba the planned amount of geological prospecting has been carried out, and the promising areas have been determined for expanding the raw material base of the existing mineral zones, and new ones have been explored. The prospecting and evaluation work for bauxites in the area of Dak Nong-Fyok Long started in 1983 has brought first positive results.

Within the framework of the "INTERMORGE" Coordination Centre, multilateral cooperation of CEMA member countries in the study and development of the mineral resources of seas and oceans has been going on since 1972. As a result of the work in the Atlantic and Pacific Oceans of 15 joint expeditions on regional geological and geophysical studies, a large amount of scientific data has been obtained which made it possible to study the geological structure of a vast area in the Central Atlantic and some areas in the Pacific, to work out the criteria of the prospecting of areas with manganese nodules, to reveal and study the areas where they are found. By joint efforts, a number of

problems connected with the supply of equipment and the development of methods have been solved, the experience of organizing and holding international expeditions has been acquired, and an international collective of highly skilled specialists has been formed.

The cooperation between the USSR and other countries in the sphere of geology on a bilateral basis has become widespread. Thus, a large amount of geological prospecting has been carried out on the territories of Mongolia, Cuba and Vietnam, where many mineral deposits have been discovered and prospected with the participation of Soviet specialists. These include, specifically the copper-molybdenum deposit Erdenetiyn-Obo, the fluorite deposits Berhe and Boro-Undur, the coal deposits Tavan-Tolgoi and Baga-Nur, the phosphorite deposits of Burenhan and Hubsugul (all in Mongolia).

Many kinds of geological prospecting are carried out with the participation of Soviet specialists on the territory of Cuba. As a result of it, the mineral and raw material potential of the country has substantially increased. New deposits of nickel and compound ore, golds, phosphates, oil and other minerals have been prospected.

In Vietnam Soviet geologists took part in the creation and consolidation of the mineral and raw material base of the country. The deposits of tin, iron ore, rare-earth metals, coal and phosphate raw materials have been explored.

In European socialist countries Soviet geologists are taking part in the implementation of major prospecting programs aimed at revealing fundamental laws of the distribution of mineral deposits with a view to forecasting deep-lying deposits. The utilization of the most up-to-date methods (including the all-round utilization of the information obtained with the help of artificial earth satellites) has made it possible to revise the existing metallogenic and tectonic-magmatic structures on a principally new basis which influenced the effectiveness of the prospecting work in those countries.

Soviet technical assistance in geology has brought impressive results also in Afghanistan, India, Algeria, Syria, Iran, Mali, Morocco, Egypt, the Congo, Democratic Yemen, Tanzania, Niger, Guinea and other Asian and African countries.

The beginning of cooperation with Afghanistan dates back to 1958: the geological structure of the country has been studied with the participation of Soviet geologists. The geological map and the map of mineral deposits at a 1:500,000 scale, as well as the two-volume monograph "Geology and Mineral Deposits of Afghanistan," have been drawn up and published. Mining and promising areas have been explored at a scale of 1:200,000-1:50,000. The deposits of oil and gas, coal, copper, barite, gold, mica, lazurite, fluorite, magnesite, celestite and building materials have been discovered and studied. Gas extracting areas have been created on the basis of the discovered deposits, and it is planned to build a major copper ore beneficiation complex.

Soviet specialists have carried out important work on assessing natural resources of oil and gas on the territory of India and the adjacent off-shore areas. First-priority areas for organizing geological prospecting have been

singled out in that country. On this basis a long-term plan of the development of the major industry which provides for insuring India's self-sufficiency in oil and gas has been developed. At present 17 oil and gas fields are being developed in India. Soviet specialists have revealed the Bombay vault on the shelf of the Gulf of Cambay near which the major gas and oil field Bombay Hay is situated.

On the first stage of the Soviet-Algerian cooperation which started in 1966, the assistance of Soviet geologists was directed at expanding the mineral and raw material base of the existing mines. The prospected reserves of compound metal ore mines and iron ore mines were substantially increased, four mercury deposits were explored and put into operation, and on the basis of them the mining and metallurgical complex "Ismail" was built in 1971. A number of tin, tungsten, lead, zinc, barite, antimony, celestite and gold deposits were explored.

In Guinea geological survey and prospecting were carried out with the participation of Soviet geologists, as a result of which the deposits of various minerals were discovered and evaluated. A major bauxite-producing enterprise operates today on the basis of the Detele deposit.

Soviet-Finnish cooperation both in geological prospecting and in scientific and technical relations is developing successfully.

Along with geological prospecting, Soviet specialists render extensive practical and methodological assistance to foreign countries in the creation and consolidation of national geological services, the organization and fitting out with Soviet equipment of complex laboratories, maintenance and repair centers and the training of the national personnel. Local specialists are trained in specialized higher and secondary educational establishments (for instance, in Conakry and Algiers Universities), as well as directly in field conditions. The work of Soviet geologists in developing countries promotes the growth of their economic potential, the achievement of true independence, the growth of employment and the improvement of the living standards of the population.

CSO: 1865/149

#### HUNGARIAN ENTERPRISES AT 'GEOEXPO-84' EXHIBITION

Moscow ECOTASS in English No 33, 3 Sep 84 pp 18-19

[Text] (Jozsef Denes, expert of the foreign trade enterprise "METROIMPEX")

"The new developments we showed here included the 96-channel seismic prospecting installation 'Wave-48' for special-purpose ships studying the sea bed and ocean floor. It has been developed by specialists of the Geological Institute 'ELGI' in cooperation with Soviet specialists who have manufactured pick-ups for this system. Two such installations will soon be supplied to the USSR.

"Another new development of 'METROIMPEX' is a fast-action analyzer of the composition of rock. Hungary has begun to produce such instruments on the basis of an agreement on the specialization and integration of production between countries grouped in the Council for Mutual Economic Assistance (CEMA) in the manufacture of equipment for geology and geophysics. The instruments operate on the radio-isotope principle of measurement, combining two methods of analysis, the neutron-activation one and the X-ray-fluorescence one. This makes it possible in a short period of time (10 to 15 minutes) to obtain information about the content of certain elements in rock samples (in percent). The radioisotope source used in it has been manufactured under a special Hungarian order by the Soviet association 'Isotope.' Such instruments will in the future find uses in joint work by Hungarian and Soviet specialists studying the sea bed, first of all to determine the presence of manganese. Currently one such instrument is used at a bauxite quarry in the USSR. Talks are now underway with Soviet foreign trade organizations on the delivery of rock analyzers to the Soviet Union in the next few years. Earlier they have been supplied to Greece, France, Switzerland, Yugoslavia and other countries.

"A series of oil and oil product analyzers is also of interest. They also are fast-acting instruments operating on the radioisotope principle of measurement. They can be used both in laboratories and in industry to determine the content of such important elements as hydrogen, sulfur, lead and iron.

"The assortment of geophysical instruments demonstrated by 'METROIMPEX' also includes small-size analyzers for detecting irradiating materials."

(Bela Kovacs, a senior official of the Roland Eötvös Institute of Geophysics)

"Starting from 1961, we have been supplying the Soviet Union through the foreign trade enterprise 'NIKEX' with 'ISN-01-24' 24-channel portable high-frequency seismic stations. These digital units with accumulation are intended for geophysical engineering and for prospecting for low-lying deposits of oil, gas, solid minerals and water. It is batch-produced in Hungary in the framework of the CEMA Coordinating Center 'INTERGEOTECHNICA.' Soviet specialists have taken part in working out technical specifications for the equipment. A total of 15 such stations will be supplied to the USSR in 1984.

"Work has also been completed this year to develop the seismic station 'Friendship.' The development effort has involved 'ELGI' specialists and their Ukrainian colleagues. The station is an explosion-safe system for use in mines. It has already undergone technical trials in Donetsk. Talks are currently under way between 'NIKEX' and the Soviet associations 'MASHPRIBORINTORG' and 'ZARUBEZHUGOL' on the delivery of such stations to the USSR in 1985. Besides, a possibility is being studied to launch production cooperation between the two countries to manufacture 'Friendship' stations.

"Visitors have also shown interest in the computerized well logging station 'KD-20' technical specifications for which have been prepared, along with specialists of the Hungarian Geophysical Institute, also by Soviet experts and specialists of other CEMA countries. The station is designed for studying geophysical changes in oil and ore wells. Two 'KD-20' stations are now in service in Leningrad and Bashkiria. Talks are being held on supplies of such stations also to Bulgaria.

"'ELGI' has also shown in Moscow acoustic and induction sondes for engineering and geophysical studies of small-diameter coal and ore wells. These acoustic sondes were developed by the institute jointly with Moscow engineers in 1983. They are already being supplied to Czechoslovakia, Romania and West Germany."

CSO: 1865/149



GISSAR SEISMO-GEOPHYSICAL OBSERVATORY COMPLETED, INCLUDING GALLERIES COVERING  
200 METERS

Moscow DOMESTIC SERVICE in Russian 0700 GMT 9 Jan 85

[Text] Seismologists of Tajikistan have penetrated into the depths of the Babatag ridge in order to listen to the earth's pulse. Two intersecting galleries have been knocked through the mountain, with an overall length of 200 meters. Apparatus necessary for observing underground tremors of 5-9 points on the 12 point scale has been installed here. This completes the formation of the Gissar seismo-geophysical observatory, which has been included in the system for collection and working out of data on earthquakes. The observatory contains a registering complex which is connected with the central geophysical station in Dushanbe, which gathers data from the territories of Central Asia and Kazakhstan.

Constant observation of the development and manifestation of earthquakes is an important part of the work by the Institute of Seismic-Resistant Construction and Seismology of the Academy of Sciences of Tajikistan. Its workers process the data of 40 seismic stations.

CSO: 1865/220



AIRBORNE MAGNETIC PULSE INSTRUMENT FOR ORE PROSPECTING

Ashkhabad TURKMENSKAYA ISKRA in Russian 3 Feb 85 p 1

[Text] L'vov -- An original aerial geophysical station has been developed at the Ukrainian Academy of Sciences' Physical-Mechanical Institute imeni Karpenko. Installed on a helicopter, it generates strong magnetic pulses which, reflecting from the ground, are recorded and processed automatically on board the aircraft. The all-seeing eye of the instrument is capable of detecting ores of metals both in the ground and also under water at depths as great as 100 meters.

FTD/SNAP  
CSO: 1865/254

19 April 1985

## SCHEMES OF USA FOR WAGING GEOPHYSICAL WARFARE SURVEYED

Moscow KRASNAYA ZVEZDA in Russian 30 Nov 84 p 3

GRADOVOY, I., colonel, doctor of military sciences

[Abstract] The article is a survey of schemes for waging so-called geophysical warfare which the author alleges are being explored in the USA and other Western countries. Among sources of his information, he cites a study by a Prof. MacDonald of the University of California, a book by Indian scientist N. Seshagiri entitled "Against the Use of Nature for Military Purposes", a commentary by a Japanese seismologist named Rikstake, and articles in Western journals and newspapers. The author separates geophysical warfare into four categories: lithospheric, hydrospheric, biospheric, and atmospheric. Among schemes he alleges to have been tried in experiments or to be under study are: creating earthquakes, tsunamis or tidal waves against target areas by means of underground or undersea nuclear explosions; inducing strong thunderstorms or excessive rainfall against target areas by influencing atmospheric processes; seeding clouds with substances to cause acid rain capable of putting equipment out of commission or disrupting radar and communications; altering temperatures over large territories by spreading substances in the atmosphere which absorb sunlight or deflect it back into space; altering the course of tropical storms; and using the force of natural electric discharges for influencing the bioelectric activity of the human brain or the mental condition of humans. Data are cited on the effects of the U.S. defoliation campaign in Vietnam.

FTD/SNAP

CSO: 1865/202

UDC: 552.321.1:550.93(470.117)

NEW DATA ON GEOLOGICAL STRUCTURE AND AGE OF GRANITOIDS OF MITYUSHEV KAMEN'  
MASSIF (NOVAYA ZEMLYA)

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 277, No 2, Jul 84 (manuscript received 9 Jan 84) pp 445-448

KORAGO, Ye. A. and CHUKHONIN, A. P., All-Union Scientific Research Institute of Geology of Mineral Resources of the Ocean and All-Union Geological Scientific Research Institute imeni A. P. Karpinskiy, Leningrad

[Abstract] The contemporary structural plan of the Mityushev Kamen' intrusive mass consists of four scattered outcroppings over a distance of 3 km. The main body of the mass consists of an oval plate with a thickness of up to 5 km contained between fractures steeply inclined to the east. Coarse-grained alaskite granites with concrete, cataclastic and blastohypidiomorphous grain structures predominate. The veined phase of the mass consists of aplite veins small in both thickness and length plus pegmatoid formations not over 30 cm thick. Most of the rocks are alaskites in chemical composition with a high silica content, low content of iron and magnesium, total alkalis about 9%. Areas of siliceous and silicon-potassium metasomatism are found in the central portion of the main body. The absolute age was determined as  $680 \pm 50$ - $735 \pm 50$  million years by the K-Ar method for biotite and U-Pb method for zircon from samples taken from the main body and its peripheral portions. The data indicate the presence of Pre-Silurian and Early Mesozoic granites in the area. Figure 1, tables 1; references 7: 6 Russian, 1 Western.  
[147-6508]

UDC: 551.21.551.23

#### ORIGIN AND AGE OF THE KHODUTKA HOT SPRINGS

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 5, Sep-Oct 84 (manuscript received 13 Apr 83) pp 49-59

KIRSANOVA, T. P. and MELFKESTSEV, I. V., Volcanology Institute, Far Eastern Scientific Center, USSR Academy of Sciences

[Abstract] The Khodutka hot springs in southern Kamchatka were first described briefly in 1911. Studies of the springs and their surroundings in 1960-1970 greatly supplemented available information. The Khodutka thermal water deposit is on the left bank of the Pravaya Khodutka River on the north-western slope of Priyemysk volcano. In structural aspects the Khodutka hot springs belong to the eastern portion of the trough-syncline of southern Kamchatka and the associated volcanic region. The region of the Khodutka hot springs is fragmented by a dense network of young tectonic faults. The Khodutka hot springs are associated with the lowest of three large eruptive funnels forming a chain about 2 km in length, probably tracing a volcanic-tectonic fault. The characteristics of the funnels indicate continuing volcanic life of the Khodutka complex. The maximum water temperature of 88°C is observed in slowly flowing shoreline springs; more rapidly flowing springs at the river bottom have a temperature of 55°C. The chemical composition of the Khodutka hot spring waters is sodium hydrocarbonate-sodium chloride, with low total mineralization (0.6 g/l). Potassium content is low, Na/Cl ratio is nonequivalent, Cl/HCO<sub>3</sub> and Cl/SO<sub>4</sub> ratios are 1.64-1.80 and 4.6-5.86, the calcium content is low and magnesium is almost completely absent. This article presents the first attempt to synthesize data on reconstruction of the eruptive history of the young volcanic center in the Khodutka complex by special geological-geomorphological studies based on the results of detailed examination of the Khodutka hot springs. Figures 4, tables 2; references 14: 10 Russian, 4 Western.  
[144-6508]

UDC: 550.834

#### POSSIBILITY OF PREDICTING EARTHQUAKES

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEOLOGIYA I RAZVEDKA in Russian No 9, Sep 84 pp 102-107

KUZ'MINA, O. A., Earth Physics Institute, USSR Academy of Sciences

[Abstract] Prediction of earthquakes requires prediction of the location, time, force and nature of the earthquake. The reliability of prediction is determined by the degree to which the theoretical concepts agree with the actual processes occurring in the earth's crust. Earthquakes cannot be reproduced in experiments nor is it possible to observe their preparation

and occurrence in detail. Studies of the fine structure of changes in the local geomagnetic field related to specific seismic events allow an approach to solution of the inverse problem: the study of the space-time characteristics of an earthquake focus and the zone of preparation in combination with various geophysical methods. Summarization and systematization of field observations, theoretical and laboratory studies should be oriented toward creation of models of earthquakes which can qualitatively and quantitatively explain the complex of phenomena accompanying the processes of preparation for earthquakes and serve as a basis for their prediction. References 7: 6 Russian, 1 Western.  
[165-6508]

UDC: 553.45(574.4)

SPECIFICS OF GEOLOGY OF SARYSHAGAN MOLYBDENUM-COPPER-PORPHYRY DEPOSIT  
(NORTHWESTERN BALKASH AREA)

Moscow IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: GEOLOGIYA I RAZVEDKA in Russian No 9, Sep 84 pp 53-60

KUDRYAVTSEV, Yu. K., IZOTOV, V. V., MEL'NIKOV, S. F. and TSAREVA, G. M.,  
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[Abstract] The Saryshagan deposit is located in the southwestern Balkash structural zone, characterized by Devonian and Carboniferous-Permian magmatic associations, a part of the southwest branch of the Devonian and western rim of the Balkash volcano-plutonic belts. Data presented by previous authors on the development of ore-bearing intrusives with clear sodium alkalinity do not correlate with the regional zonality in the distribution of various types of copper-molybdenum deposits established for the Balkash belt. Studies made by the authors in recent years indicate a more probable Devonian age of the deposit and provide a basis for positive estimation of the potential ore content of early magmatic associations in a number of segments of the Devonian belt. Geological structural diagrams of the area are presented. The major geological feature of the Saryshagan deposit is the relationship of ore formation to low-alkalinity magmatic associations of oxygen composition including plagiogranites, plagiogranites and granite-porphyrries. This indicates the significance of quartz metasomatites among hydrothermally altered rocks near the ore, as well as the primarily copper composition of the ore. The data obtained indicate an early Devonian age of the deposits, though similarity of rock composition with Silurian volcanites indicates that an earlier age is possible. Figures 3, tables 2; references: 5 Russian.  
[165-6508]

UDC: 551.24.243.6.(571.642)

INFLUENCE OF FAULTS ON FORMATION OF STRUCTURE OF SAKHALIN ISLAND

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEOLOGIYA I RAZVEDKA in Russian No 9, Sep 84 pp 16-22

ROZHDESTVENSKIY, V. S., Sakhalin Complex Scientific Research Institute, Far Eastern Scientific Center, USSR Academy of Sciences

[Abstract] Slip-strike fault dislocations on Sakhalin Island have attracted the attention of a number of geologists. Instrumental analysis of displacements in geodynamic measurement areas and data obtained in studies of earthquakes indicate complex contemporary horizontal movements in the area. The processes of fault formation are quite complex and not fully understood even in classical regions of slip tectonics such as California. Additional complications in the structure of fault zones are introduced by local stresses related to introduction of dikes of intrusive rock along faults, as well as clay and serpentine diapirs forming complex anticlinal structures in the upper structural stage. The overall structural plan of deformations of Sakhalin Island and specifics of its geological structure indicate participation of a submeridional fault slip in the formation of the structure of the island. Figures 5; references: 18 Russian.  
[165-6508]

UDC: 551.241(578.172)

DEEP STRUCTURE OF ARAL-CASPIAN REGION

Moscow SOVETSKAYA GEOLOGIYA in Russian No 10, Oct 84 pp 67-74

BABADZHANOV, T. L. ("Uzbekgeofizika" Geological Production Association), KUNIN, N. Ya., and SHEYKH-ZADE, E. R., Earth Physics Institute, USSR Academy of Sciences)

[Abstract] Determination of the oil and gas content of deep structures in the territory between the Caspian and Aral Seas is difficult, largely due to the lack of knowledge concerning many aspects of tectonic regionalization and the history of geological development in this region. New results of physical studies indicate that a refracting boundary previously considered to be the basement surface is probably related to slightly dislocated Carboniferous and Devonian, possibly more ancient Paleozoic formations in the Beyneusskiy, Samskiy and Kosbulakskiy depressions. The approximate thickness of these formations is estimated at 3 to 5 km, significantly less than in the southern Emba upthrust but more than in the Barsakel'messkiy depression. Based on the specifics of basement relief and boundary velocities along its surface, two groups of structures are clearly differentiated: upthrusts and relatively shallow depressions (downwarps), and deep depressions. Taking into account the degree of study of the M discontinuity by



seismic work, as well as the accuracy of studies, the region can be divided into the northern, western and southwestern zones, with the southeastern zone least studied. The results of recent studies indicate that throughout the Aral-Caspian region a magma-metamorphic crust 25 to 42 km has developed. Areas of thickness less than 30 km are seen only in areas of development of a granite-free basement with long-term stable sediment accumulation with a predominance of marine facies. Proposals for future exploration of the area are outlined. Figures 4; references: 17 Russian. [137-6508]

UDC: 533.463(574.3)

PROSPECTS FOR TUNGSTEN MINING IN AGADYRSKIY ORE REGION (CENTRAL KAZAKHSTAN)

Moscow SOVETSKAYA GEOLOGIYA in Russian No 10, Oct 84 pp 20-30

AKYLBEKOV, S. A. ("Tsentrkazgeologiya" Geological Production Association), VAL'KOV, V. O. (All-Union Scientific Research Institute of Mineral Raw Materials), TYUGAY, O. M. ("Tsentrkazgeologiya" Geological Production Association) and FROLOV, A. A. (All-Union Scientific Research Institute of Mineral Raw Materials)

[Abstract] The territory of the Agadyrskiy ore region encompasses the area where three great structures of central Kazakhstan join: the Sarysuyskiy synclinorium, the Zhaman-Sarysuyskiy anticlinorium and the Uspenskiy graben-synclinorium. The major features of the geological structure of this area are described. According to deep seismic sounding and gravimetry, the fault zone here is a crustal-mantle zone. The tectonic-magmatic history of development of the region is discussed. The Uspenskiy zone was formed as a result of constant pressure from the Zhaman-Sarysuyskiy anticlinorium against the more stable Tekturmasskiy anticlinorium and the progressively rising Sarysuyskiy synclinorium. The characteristics of manifestation and distribution of tungsten ores are discussed. Ore formations, located in the center of a great circular structure, are distinguished by secondary aureoles of all of the typomorphic ore elements and by reduced magnetic field values. The prospects for tungsten mining are evaluated. Using the informative complex criterion of a large graviminimum within which favorable tectonic, magmatic and geochemical factors are combined, it is possible to minimize the number of prognostic criteria used, allowing more rapid and simpler evaluation of the territory. Figures 3, tables 1; references: 10 Russian. [137-6508]

UDC: 551.732:56.016.3(574)

STRATIGRAPHY AND COMPLEXES OF CONODONTS IN LOWER PALEOZOIC OF NORTHERN  
BETPAK-DALA (CENTRAL KAZAKHSTAN)

Alma-Ata IZVESTIYA AKADEMII NAUK KAZAKHSKOY SSR in Russian No 5, Sep-Oct 84  
pp 12-18

GERASIMOVA, N. A., BESSTRASHNOV, V. M., NOVOKOVA, M. Z. and KURKOVSKAYA, L. A.,  
Moscow State University imeni M. V. Lomonosov, Moscow

[Abstract] A study is made of volcanogenic-siliceous-terrigenous and siliceous strata in the Lower Paleozoic of northern Betpak-Dala. In a detailed study of the region of Mount Yel'shibay and Mount Karabas in 1980-1982, the volcanogenic-siliceous terrigenous formations were divided into a terrigenous mass, the Burubaytal'skaya and Maykul'skaya suites. The petrographic composition of each of these subdivisions is described. The Lower and Middle Ordovician in northern Betpak-Dala is most fully characterized by conodont complexes of various stages. Comparisons presented in this article allow the age interval of analogues to the Burubaytal'skaya and Maykul'skaya suites to be refined. The question of the age of the terrigenous masses beneath the Burubaytal'skiy suite and its analogues is less clear. Figures 3; references: 12 Russian.  
[154-6508]

UDC: 551.24

DETAILED VARIANT OF TECTONOFACIAL ANALYSIS

Alma-Ata IZVESTIYA AKADEMII NAUK KAZAKHSKOY SSR in Russian No 5, Sep-Oct 84  
pp 19-24

PATALAKHA, Ye. I., LUKIYENKO, A. I. and DERBENEV, V. A., Geological Sciences  
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[Abstract] Tectonofacial analysis has developed in three methodological variants: profile review, area review and area detailed studies. Whereas studies by the first two variants have been performed for some time, studies by the third variant have only begun in recent years. These studies amount to a detailed tectonofacial survey, usually combined with a geological survey. This article presents some preliminary data on two detailed studies made in recent years. Tectonofacial analysis allows the production of an image of structural zonality for the lower structural level, at times revealing intensive and contrasting development of fractured zones in the neighborhood of faults. The lower structural levels of the Zhingel'da region constitute an intermediate cleavage zone. A high content of viscous fractures is present at this level. The frequent zones of fracturing near faults merge together at the level of tectonofacies IV-VI with a common scale of variations with tectonofacies V-X. The tectonofacies on the maps and in the sections presented are narrow mutually parallel linear zones, conformally mapped in

smooth form into a system of faults, the seams of which are marked by bands of higher tectonofacies. According to the analysis, cleavage mesozones are complex combinations of plate-like blocks displaced with respect to each other and bounded by vertical or sloping viscous fractures. This disintegration reflects intensive processes of viscous flow of the layers. Figures 5; references 8: 7 Russian, 1 Western.  
[154-6508]

UDC: 552.541:551.736(571.64)

#### PERMIAN LIMESTONES IN SAKHALIN CROSS SECTION

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian No 10, Oct 84 (manuscript received 8 Jun 82) pp 51-57

BRAGIN, N. Yu., KOROLYUK, Ye. V. and RIKHTER, A. V., Geology Institute, USSR Academy of Sciences

[Abstract] A study was made of certain limestones of the Daldagan series of Taulan-Armudan ridge, the Novikov suite of Tonino-Anivskiy penninsula, limestone from metamorphosed rock of the Susunayskiy ridge to answer the question of age relationships of the limestones and surrounding volcanogenic-siliceous rock. Processing of the data showed that only Permian and Mesozoic limestones were involved. The Permian limestones of Sakhalin were found to be residues of organogenic structures. The rock-forming organisms were primarily sponges and hydroids. The complex of late Permian foraminifera on Sakhalin is similar to the complex of the Coliniella parva zone of the Primor'ye area, though Coliniella per se are not present. In the Late Permian Sakhalin was an intermediate area with features of both Mediterranean and boreal biogeographic belts. In the Late Cretaceous, the volcanogenic-siliceous sediment accumulation continued only to the east of the newly formed, broader Cretaceous upthrust which formed the framework of present-day central and southern Sakhalin. Figures 2; references: 9 Russian.  
[138-6508]

UDC: 550.384:551.736.3/761.1(470.117)

## PALEOMAGNETIC CROSS SECTION OF UPPER PERMIAN AND TRIASSIC DEPOSITS ON NOVAYA ZEMLYA

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian  
No 10, Oct 84 (manuscript received 13 Jun 83) pp 42-50

GUREVICH, Ye. L. and SLAUTSITAYS, I. P., All-Union Geological Prospecting  
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[Abstract] A paleomagnetic study of the Permian and Triassic deposits of Novaya Zemlya was undertaken in 1980 to refine knowledge concerning the age of the deposits. Oriented specimens were taken from two Permian and Triassic cross sections 5 km apart on two limbs of a fold on Gusinaya Zemlya peninsula. The distribution of  $J_n$  vectors in the deposits before and after heat treatment and aging is diagrammed. The cross section includes six magnetic zones stretching from the Late Permian through the Early Triassic. The boundary between the Permian and Triassic passes through red rock of the Sedoyakhskaya suite. The matching paleomagnetic directions for Novaya Zemlya and the Pechora region indicate that at the end of the Late Permian and the beginning of the Early Triassic, Novaya Zemlya and the Timan-Pechora area consisted of a single rigid plate. Figures 3, tables 3; references: 8 Russian.  
[138-6508]

## PETROPHYSICAL DESCRIPTION OF SECTION OF SAATLY SUPERDEEP BOREHOLE IN 3500-7500 m INTERVAL

Baku IZVESTIYA AKADEMII NAUK AZERBAJDZHANSKOY SSR, SERIYA NAUK O ZEMLE in Russian No 2, 1984 pp 113-121

SALEKHLI, T. M., GADZHIYEV, T. G., BAYUK, Ye. I., POTAPOVA, Ye. I., BAGIN, V. I., SULTANOV, L. A. and NOVRUZOV, Z. A.

[Abstract] Results from studies of the physical properties of the 3500-7500 m depth level of the Saatly superdeep well, involving the study of more than 5000 specimens, are presented. A petrophysical section in graphic form is presented. The material composition and physical properties of the retrieved specimens are discussed. The section of the column is broken down into individual complexes. Beginning at a depth of 6100 m, the section correlates well with respect to petrographic and petrophysical data with the section of the lower volcanogenic strata in the Caucasus (Malyy Kavkaz). Figures 3; references: 4 Russian.  
[132-6508]

UDC: 550.834.5

INFLUENCE OF SCATTERING SURFACES ON SEISMIC WAVE FIELD

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 9, Sep 84 (manuscript received 14 Oct 83) pp 121-126

GIK, L. D., Geology and Geophysics Institute, Siberian Department, USSR Academy of Sciences, Novosibirsk

[Abstract] A study is made of the qualitative effects of scattering, assuming a pulsed harmonic form of the incident signal, a section of a sine wave of limited duration. The effect of the scattering surface is manifested qualitatively as a decrease in the level of the pulse, particularly the first return of the pulse, plus an increase in the pulse length. Effects which occur as the source is brought closer to the scattering surface to a distance comparable to the dimensions of a roughness element in the surface are studied. The dominant influence on the wave field in this case is that of the roughness element located closest to the signal source. Sample seismograms illustrate the effect of transmission of the signal through the scattering surface as the source comes closer to it. Numerical modeling indicates that variation of a group of sources to yield a field adapted to the scattering surface can reduce the negative effects of scattering. Figures 5, references: 5 Russian.  
[134-6508]

UDC: 550.343.4:554.24(575.4+497.1)

SIMILARITY OF GEOLOGICAL CONDITIONS FOR OCCURRENCE OF EARTHQUAKES AT INDIVIDUAL SEISMICALLY ACTIVE REGIONS OF KOPETDAG AND DINARIC ALPS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ZEMLI in Russian No 11, Nov 84 (manuscript received 9 Jun 83) pp 18-28

ROGOZHIN, Ye. A. and BORISOV, B. A., USSR Academy of Sciences, Earth Physics Institute imeni O. Yu. Schmidt

[Abstract] The Dinaric Alps of Yugoslavia and the Soviet Kopetdag are comparable seismic regions. Both folded systems are in an alpine folded belt and there are many similarities of tectonic structure and developmental history. The geological conditions of the two regions are compared. It is found that large earthquakes develop where it is possible for significant elastic stresses to accumulate, i.e., where consolidated blocks of the earth's crust move with respect to each other in areas where regional compression occurs. The conditions of greatest contrast of movements in the outer zone of an alpine folded area are found at the boundary of the outer zone of the folded system and a contiguous downwarp. The presence of systems of young diagonal or transverse active faults provides a possibility of block movements, the formation of subhorizontal shear along the surface

of certain stratigraphic horizons being quite probable. Earthquake foci are localized in areas of maximum shear stress, i.e., boundaries of blocks of the crust developing in different (particularly late) stages of geological history in different ways. In the regions studied seismically active sectors have a stable width of "rigid" blocks between transverse diagonal discontinuities, approximately 30 to 35 km. This block size is apparently suitable for development of strong earthquakes with a magnitude 6 or more. Figures 3; references 32: 22 Russian, 10 Western.  
[181-6508]

UDC: 550.34.01:553.98

# SEISMOGENIC DISJUNCTIVE POINTS AND PATTERN OF DISTRIBUTION OF OIL AND GAS DEPOSITS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ZEMLI in Russian No 11, Nov 84  
(manuscript received 22 Jun 83) pp 10-17

GUBERMAN, Sh. A. and PIKOVSKIY, Yu. I., Moscow State University imeni M. V. Lomonosov; Applied Mathematics Institute, USSR Academy of Sciences

[Abstract] This work is based on three assumptions: a model of terrestrial seismic activity in which a strong earthquake leads to redistribution of masses, changing the rotational velocity of the earth, with disturbances at both poles when the rotational velocity reaches a minimum and there is a resulting D wave propagating along the meridians at constant velocity and serving as the triggering mechanism of other strong earthquakes; strong earthquakes develop only at disjunctive points, but not at all such points; mineral deposits are related to disjunctive points. A hypothesis is formed that large oil and gas deposits occur at discrete latitude intervals of  $2.81^\circ$ , 18 of the 21 largest deposits in the world lie at these latitudes. A table and world map illustrate the distribution of large deposits by latitudes. A more detailed map of eastern Siberia shows locations of oil deposits and the suspect latitudes. Specific areas where searches for oil and gas should be conducted are noted. Figures 4, tables 2; references 23: 21 Russian, 2 Western.  
[181-6508]



UDC: 550.42:546.791.841:552.323(571.66)

## URANIUM AND THORIUM IN CENOZIC BASALTOIDS OF KAMCHATKA

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 279, No 2, Oct 84 (manuscript received 17 Apr 84) pp 463-467

PUZANKOV, Yu. M., Institute of Geology and Geophysics imeni the 60th Anniversary of the USSR, Siberian Department, USSR Academy of Sciences, Novosibirsk

[Abstract] An analysis is presented of the distribution of radioactive elements in volcanic formations of basic composition, considered as a single rock group. Two great structural units are distinguished in Kamchatka: the western and eastern tectonic zones, separated by the central Kamchatka ridge. The mean compositions of Kamchatka Cenozoic basalts are systematized and illustrated graphically in  $\text{SiO}_2$  -  $\text{Na}_2\text{O} + \text{K}_2\text{O}$  coordinates. The points fall in two clusters, allowing the entire group of samples studied to be divided into two classes corresponding to true basalts and basic andesites. The composition and the status of the area of basaltoid melt generation beneath Kamchatka can be characterized by the thorium-uranium ratio. For volcanic formations, the ratio is usually below 1.5-2.1. Figures 2, tables 1; references: 11 Russian.  
[157-6508]

UDC: 551.24.(570)

## PRE-UPPER VISEAN STRUCTURAL NONCONFORMITY OF SOUTHERN EMBA UPTHURST BASED ON COMMON DEPTH POINT METHOD SEISMIC MATERIALS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 279, No 2, Oct 84 (manuscript received 16 Apr 84) pp 422-425

GONCHAROVA, T. V., SAPOZHNIKOV, R. B. and SHLEZINGER, A. Ye., Turlanskaya Geophysical Expedition, Chimkent; Geology Institute, USSR Academy of Sciences, Moscow

[Abstract] Seismic studies made in 1982 in the southern Emba upthrust have yielded significant new information on the structural nonconformity within the Paleozoic cross section, allowing it to be correlated with seismic materials from past years and materials on other regions of the upthrust. Deformed terrigenous rocks from the Upper Devonian and Lower Carboniferous were discovered in the arch of the southern Emba upthrust at a depth of up to 2 km directly beneath Middle Jurassic deposits in the Zhanasu area studied. Analysis of the wave field shows that the Paleozoic rocks beneath the seismic horizon D in the Zhanasu area are greatly deformed. The Paleozoic structural nonconformity separating the gently dipping and deformed layers passes near the boundary of the upper Visean terrigenous formations up to 400-500 m below the base of the upper Visean carbonates. The deformed

complex of the core with a sharp structural nonconformity is covered by gently dipping Late-Middle Visean terrigenous and carbonaceous rocks. Figures 1; references: 10 Russian.  
[157-6508]

UDC: 550.34.04

NONUNIFORMITY OF INSTRUMENTAL DATA ON STRONG EARTHQUAKES IN SEISMIC CATALOGS (1904-1980)

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ZEMLI in Russian No 10, Oct 84 (manuscript received 2 Mar 83) pp 5-16

PEREZ, O., Lamont-Doherty Geological Observatory, Columbia University; Venezuelan Seismologic Research Organization

[Abstract] An analysis of the agreement in world remote seismic observations and definitions of the magnitudes of strong earthquakes between 1904 and 1980 is presented. The analysis was based on a study of seismologic catalogs in order to determine at what point instrumental data become complete for earthquakes with magnitude over 6.0 or over 7.0. Quantitative magnitude corrections are presented for earthquakes with magnitudes in this range based on changes in seismic instrumentation in the past few years. It is assumed that data obtained by the worldwide standard seismic network beginning in the early 1960's are typical for all remaining periods of the past 80 years and sufficiently complete. If the assumptions are correct, the noticeable reduction in frequency of events with magnitude over 6 since 1948 may be explained by the fact that the movement of tectonic plates has interruptions, causing a change in the frequency of events with magnitude of at least 7 around 1950, as well as similar change with respect to events with magnitude of 6.0-6.9 since 1963. The authors propose an alternate explanation: inaccurate instruments used in the past overestimated the magnitude of earthquakes in past times. Corrections are suggested to the magnitudes of past events to make the catalogs of such events more uniform over time since 1904. Figures 6, tables 3; references 13: 2 Russian, 11 Western.  
[146-6508]

UDC: 550.34.016

#### ESTIMATES OF SEISMIC ACTIVITY STABILITY

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ZEMLI in Russian No 10, Oct 84  
(manuscript received 14 Apr 82) pp 17-25

NERSESOV, I. I. and TEYTEL'BAUM, Yu. M., Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy of Sciences

[Abstract] An attempt is made to estimate the reliability of mean seismic activity indices and clarify the necessary conditions for the production of stable values. If seismic conditions are constant, the reliability of mean estimates should increase with an increase in the volume of data used. The seismic process in the close space-time vicinity of a single relatively large earthquake is found to be unstable. In order to obtain stable estimates of earthquake activity, series must be analyzed which are at least twice as long as the period or cycle of activity in the region. In the focal areas of large earthquakes, instability results primarily from aftershocks of the main events; in tectonic areas comparable with the zones of preparation of large earthquakes the loss of stability in time series is caused primarily by seismic quiet and activation of seismicity related to the effects of large earthquakes. In large areas and regions the major cause is the periodicity of seismic activity. Series of observations of at least 10 years in length in relatively quiet areas, several hundreds of years in length in the vicinity of catastrophic earthquakes, are required to obtain stable results. Figures 6, tables 2; references 13: 12 Russian, 1 Western. [146-6508]

#### SEISMIC STUDIES OF EARTH BY VIBRATION SOURCES

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 10, Oct 84 pp 76-87

NIKOLAYEV, A. V., doctor of physical-mathematical sciences

[Abstract] Vibration seismic studies are coming into their own. The idea of the method is to probe the depths of the earth with continuous oscillations produced by a vibrator which sends down a multiphase signal of variable frequency. The complex seismograms produced are correlated with the probing signal to produce a correlogram on which each individual vibration signal is time compressed and increased in amplitude. The longer the signal, the greater the amplitude of this compressed pulse. Correlation compression allows detection of very weak waves from low power sources after passing through great thicknesses of the earth's crust. By analogy with other physical methods, it is possible to produce seismic tomograms and holograms by the use of a network of seismic vibrators spread out over a large area and mobile recording systems. Since the vibrator does not alter the earth beneath it, it is possible to produce waves of the same characteristics over and over again. Seismic tomography and holography thus allow the

significant aspects of the structure of the medium beneath the network of stations to be revealed. A half-dozen vibrators forming a network measuring 1000 x 1000 km are sufficient to support investigation of the crust and upper mantle within the area they surround. Seismic vibrators are also useful for studying the changes in the properties of rock which occur under the influence of vibrations. Figures 8.

[143-6508]

UDC: 550.348

#### REPRESENTATION OF FOCAL MECHANISMS OF EARTHQUAKES ON SPHERE OF STRESSES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 277, No 3, Jul 84  
(manuscript received 2 Dec 83) pp 585-589

YUNGA, S. L., Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy of Sciences, Moscow

[Abstract] The introduction of the definition of the focal mechanisms of earthquakes in seismologic practice was the foundation for the study of the stressed state of seismically active areas of the earth. This work suggests that the focal mechanisms of earthquakes be represented on the surface of a  $\Sigma$  sphere, then the type of stressed state of the seismically active volume be determined by the use of a separating nodal plane. The possibility for an unambiguous formulation of the task of determination of the focal mechanism and tectonic stresses is demonstrated. As an example of the application of the method suggested, the stressed state of the upper portion of the crust in the zone of joining of the Pamir and Tien Shan, the location of a highly sensitive network of seismic stations, is studied. Figures 1; references: 7 Russian.

[148-6508]

UDC: 550.341

#### SELF-SIMILARITY OF DISTRIBUTION OF AFTERSHOCKS BY MAGNITUDE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 277, No 3, Jul 84 (manuscript received 21 Nov 83) pp 573-577

PROZOROV, A. G., Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy of Sciences, Moscow

[Abstract] A study is made of the question of self-similarity of the distribution of aftershocks by magnitude, as well as the influence of the main earthquake on the magnitude of the maximum aftershock. This study is based on a catalog of earthquakes provided by the U.S. Geological Survey, from which normal shocks with focal depth not over 60 km and magnitude at least

4 between 1964 and 1980 were selected. To eliminate subjectivism in distinguishing aftershocks a computer algorithm was developed which uses the successive approximations method, the catalog being considered the first approximation. The operation of this program is briefly described. It was found that the changes in the medium after an earthquake do not make aftershocks relatively weaker in the actual catalog in comparison with a randomized list. The distribution of aftershocks by magnitude is quite satisfactorily described by a truncated repetition rule  $F_M(x)$ . The magnitudes of aftershocks are practically independent of each other; the energy limit of maximum aftershocks is quite weak. The similarity of repetition rules for main shocks and aftershocks indicates self-similarity of the processes governing the distribution of earthquakes by energies. Aftershocks of magnitude similar to the main earthquake are not an exception. Thus, a strong earthquake does not necessary relieve most of the energy accumulated in the focus. Figures 1; references 12: 9 Russian, 3 Western.  
[148-6508]

UDC 550.348.098.64.(575.1)

SPATIAL-TEMPORAL VARIATIONS OF SLOPE OF EARTHQUAKE FREQUENCY OF RECURRENCE CURVE FOR EASTERN UZBEKISTAN AND ADJACENT TERRITORIES

Tashkent UZBEKSKIY GEOLOGICHESKIY ZHURNAL in Russian No 6, Nov-Dec 84  
(manuscript received 18 May 84) pp 18-22

USMANOVA, M. T. and SOBOLEV, G. A., Seismology Institute, Uzbek Academy of Sciences

[Abstract] The spatial-temporal distribution of seismicity in Eastern Uzbekistan was analyzed using data from the catalogue of earthquakes for this region for the period 1962-1979 with  $K = 9-13$  and with a focal depth to  $H \leq 40$  km. For Eastern Uzbekistan the slope of the earthquake frequency of recurrence curve  $\gamma$  was completed by the maximum probability method for a grouped sample:

$$\hat{\gamma} = \lg \left[ 1 + \frac{N_{\Sigma}}{\sum_{j=0}^{\infty} j N_{(k_0+j)}} \right],$$

where  $N_{\Sigma}$  is the size of the sample;  $N_{(k_0+j)}$  is the number of earthquakes of the class  $(k_0+j)$ ;  $N_{k_0}$  is the number of earthquakes of the lower usable energy class. The seismically active zone was broken down into overlapping elementary volumes  $\Delta S_i = 100 \times 100 \times 40$  km, for each of which the  $\hat{\gamma}$  and  $\sigma_{\hat{\gamma}}$  values were computed in order to check the reliability of this method. Earlier studies gave a mean long-term curve slope  $\gamma = 0.48 \pm 0.05$ . The  $\gamma$  values

computed by the least squares method confirm the long-term nature of the curve for 1962-1979. The  $\hat{\gamma}$  values, computed by the maximum probability method for this same period, are close to the other evaluations. The stability of distribution of the  $\hat{\gamma}$  parameter in time and area was checked by a comparison of  $\hat{\gamma}$  maps prepared for 1962-1970 and 1962-1979. Certain differences in the maps are explained. Short-period changes of the  $\hat{\gamma}$  parameter were also analyzed. In general, it was shown that strong earthquakes with  $K \geq 13.0$  in the region are associated with zones with  $\hat{\gamma} \leq 0.40$ . It is shown that monitoring of  $\hat{\gamma}$  variations can be used in long-range earthquake prediction. Figures 2; references: 10 Russian. [214-5303]

UDC 551.21

#### PREDICTION OF WHEN AVACHA VOLCANO ON KAMCHATKA WILL ERUPT

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 6, Nov-Dec 84 (manuscript received 10 Mar 83) pp 107-111

MELEKESTSEV, I. V. and KIR'YANOV, V. Yu., Volcanology Institute, Far Eastern Scientific Center, USSR Academy of Sciences

[Abstract] Avacha Volcano is situated about 25 km from Petropavlovsk-Kamchatskiy and it is therefore vital to predict its future activity. The last eruption occurred on 25 February 1945. Future eruptions could constitute a serious danger to the city. An effort to make such a prediction was undertaken on the basis of tephrochronological investigations made at various times between 1959 and 1982. Analysis of these data indicate that at least in the next few decades (possibly 100-200 years or more, up to the beginning of the next eruptive cycle) there will be no strong eruptions of the 1945 type, provided that there is no repetition of the events observed in 1737-1738. However, small irregular phreatic and phreatomagmatic eruptions are entirely probable even earlier due to random plugging of the volcanic neck with its burial by clastic material and ice as a result of intensive collapse of the steep crater walls. The assumption of a great duration of a rest period does not mean that Avacha is incapable of strong eruption in the future. Such an event is possible in the next eruptive cycle. This would be consistent with the history of the volcano during the last 6,500-7,000 years and theoretical computations. The authors disagree with the predictions of P. I. Tokarev (VULKANOLOGIYA I SEYSMOLOGIYA, No 3, pp 77-90, 1979) who predicted a violent eruption in September 1986 (an erroneous conclusion based on the assumption that the current eruptive cycle was continuing, whereas it ended in 1945). Tables 1; references 17: 16 Russian, 1 Western. [203-5303]



UDC 550.341

LONG-RANGE STATISTICAL PREDICTION OF SPATIAL-TEMPORAL DENSITY OF STRONG  
EARTHQUAKES FOR KURIL ISLANDS

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 6, Nov-Dec 84 (manuscript  
received 10 May 83) pp 92-102

SHURYGIN, A. M. and ODINETS, M. G., Moscow University; Oceanology Institute,  
USSR Academy of Sciences

[Abstract] A method has been developed for predicting seismicity on the basis of the statistics of earthquakes occurring in the same region. The Kuril Islands are used as an example. Some characteristics of the seismic process important for selecting a probabilistic prediction model are examined. It is shown that a series of earthquakes can be represented as an ensemble of points in five-dimensional space (three spatial coordinates, magnitude  $M$  and time  $t$ ). Deep-focus earthquakes are not taken into account in order to be free of the strong dependence on focal depth. In actuality, a two-dimensional problem is examined: analysis of the distribution of points (earthquakes) on the plane  $(x, t)$ . Earthquakes of different intensity have different patterns of spatial and temporal localization. In order to define them earthquakes must be divided into classes, each of which can be regarded as internally relatively uniform. The class of earthquakes with  $M \geq 6$  is examined. In this study  $M = 7.3$  was selected because most earthquakes have a lesser amplitude and they determine the statistical patterns of distribution in space and time. One of these patterns is the formation of clusters, most of which are the foreshocks and aftershocks of very strong earthquakes. If the statistical patterns of distribution of such clusters are found and used for prediction, there will be an indirect solution of the problem of predicting very strong earthquakes (at least those accompanied by aftershocks). This problem is solved using Kuril Island data for 1936-1982. It is shown that a complex cyclicity, whose basis is a cycle of 5.5 years, is characteristic for the appearance of earthquake clusters. The proposed indirect method for predicting earthquakes with  $M \geq 7.3$  on the basis of a prediction of the density of earthquakes with  $M \geq 6$  was successful. A retrospective prediction for 1975-1982 on the basis of data for 1936-1974 revealed two earthquake clusters containing all five earthquakes with  $M \geq 7.3$  occurring during this time with an accuracy to 3 months and 200 km in projection onto the axis of the Kuril Arc, commensurable with the focal extent of very strong earthquakes. On the assumption of persistence of the seismic regime the authors predicted the density of earthquakes in 1983-1987 on the basis of data for 1936-1982: an anomalously high earthquake density in late 1983-early 1984 and in mid-1986 in the Southern Kurils. (In actuality an earthquake with  $M = 7.5$  occurred there in late March 1984.) Figures 1, tables 2; references 8: 6 Russian, 2 Western.

[203-5303]

UDC 551.214.551.23(265.53)

UNDERWATER GAS-HYDROTHERMAL ACTIVITY ON NORTHWESTERN SLOPE OF PARAMUSHIR  
ISLAND (KURIL ISLANDS)

Moscow VULKANOLOGIYA I SEISMOLOGIYA in Russian No 6, Nov-Dec 84 (manuscript  
received 18 Jul 83) pp 66-81

AVDEYKO, G. P., GAVRILENKO, G. M., CHERTKOVA, L. V., BONDARENKO, V. I.,  
RASHIDOV, V. A., GUSEVA, V. I., MAL'TSEVA, V. I. and SAZONOV, A. P.,  
Volcanology Institute, Far Eastern Scientific Center, USSR Academy of  
Sciences

[Abstract] In April 1982 special geophysical observations were made to  
study the area of a reported submarine volcanic eruption in the neighborhood  
of Paramushir Island (Kurils). At the reported point specialists on the  
scientific research ship "Vulkanolog" discovered a "plume" of anomalous  
water. Such "plumes" had been observed earlier in zones of submarine fumar-  
oles. However, in this particular area no previous indications of volcanic  
activity had been observed. The following observations were made: continuous  
seismic profiling, magnetic survey, gas profiling and temperature survey of  
water surface, temperature measurements, sampling and analysis of water  
samples from different horizons and at different distances from the "plume,"  
sampling and analysis of water specimens and the pore water present in them.  
The chemical composition of the sea water and the gases dissolved in it,  
the granulometric and chemical composition of the sediments, the ratios of  
oxygen isotopes in pore and bottom waters reliably indicate that the "plume"  
of anomalous water was formed by underwater gas-hydrothermal emanations. It  
was associated with a zone of increased rock fragmentation and was not direct-  
ly related to any active volcanic center. Figures 7, tables 5; references 24:  
16 Russian, 8 Western.  
[203-5303]

UDC 551.21:550.34

VOLCANIC TREMORS AND EARTHQUAKES OF GORELYY VOLCANO DURING ERUPTION PERIOD  
1980-1981

Moscow VULKANOLOGIYA I SEISMOLOGIYA in Russian No 6, Nov-Dec 84 (manuscript  
received 17 Jan 84) pp 3-17

GAVRILOV, V. A., GORDEYEV, Ye. N., IVANOV, V. V., IVSHIN, V. M., STEPANOV,  
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[Abstract] Activity of Gorelyy Volcano began in 1977, increased gradually  
until June 1980, when an explosive eruption occurred from the central crater,  
continuing for 13 months up to 3 July 1981. During the last 2 1/2 years the  
volcano has been quiet, being activated only sporadically. The

instrumentation and methods for seismometric observations are described. Radiotelemetric instrumentation was used for the first time in Soviet volcanological observations during an eruption. For the first time for Kamchatkan volcanoes it was possible to study volcanic tremors associated with activity of the phreatic and phreatomagmatic types. The distinguishing characteristic of this tremoring was a marked instability of its intensity in time, not always correlating with apparent volcanic activity. The spectral composition of these tremors remained virtually constant during the entire observation period. These results agree with data obtained in the course of phreatic and phreatomagmatic eruptions of other volcanoes of the world where tremor activity of the same intensity has been registered at similar epicentral distances before and during eruptive activity. The following are the principal quantitative characteristics of tremor activity: maximum intensity of tremors did not exceed  $2 \cdot 10^4 W$  (mean value  $5 \cdot 10^3 W$ ). The main intensity of the tremor activity is concentrated at frequencies below 1 Hz; the spectral density of the displacement decreased by two orders of magnitude with an increase in frequency from 0.5 to 5 Hz; in the spectrum of tremor activity there were stable maxima at the approximately multiple frequencies 0.55, 0.9 and 1.5 Hz. The total seismic energy of the tremors during the entire period of the eruption was  $8.6 \cdot 10^{11} J$ . It can therefore be postulated that under the central part of the volcanic structure there is a source of tremors stable in dimensions and position, in the near zone generating waves of a virtually constant spectral composition. Figures 7, tables 1; references 24: 13 Russian, 11 Western.  
[203-5303]

UDC 550.340.5

# SOUNDING BY ARTIFICIAL FIELD FORMATION METHOD IN STUDYING TEMPORAL CHANGES OF ROCK CONDUCTIVITY IN SEISMICALLY ACTIVE ZONES

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 4, 1984 (manuscript received 16 May 83) pp 64-70

AVAGIMOV, A. A., ATAYEV, A. K. and SUKHOMLIN, V. F., Seismology Institute, Turkmen Academy of Sciences

[Abstract] The applicability of the method for sounding of the crust by artificial generation of a vertical magnetic field was investigated in the Ashkhabad test area for studying temporal changes in the conductivity of rocks in a seismically active zone. Stationary electromagnetic observations are made in the zone along a fault because temporal changes in tectonic stresses and strains are most contrasting and differentiated at the boundary of crustal blocks. Three local seismic events occurred during the period of observations. The article discusses the temporal distribution of resistivity and various characteristics of the periods of preparation for these events. The considered method was effective in determining these parameters which are valuable in predicting future earthquakes. An observation method has

been developed which ensures discrimination of the maximum useful signal of anomalous temporal changes in resistivity associated with dynamics of the medium. A technique was worked out for the analog registry of pulses from the artificially generated field (the graphic accumulation method is used). It could be demonstrated that anomalous temporal fluctuations of rock resistivity in a fault zone are caused both by fissure formation and fault zone deformation. The observable temporal fluctuations of conductivity have a high predictive value. Figures 3; references: 10 Russian. [173-5303]

UDC 553.7+550.34

## HYDROGEOLOGICAL AND GAS-GEOCHEMICAL EFFECTS OF POWERFUL SURFACE SHOT

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 279, No 6, Dec 84  
(manuscript received 11 Mar 84) pp 1334-1339

GOKHBERG, M. B., KISSIN, I. G., VOYTOV, G. I., SHEBERDYEV, S. Sh.,  
BERDYEV, K. B., SERDYUKOV, V. Ya., KHODZHAKULIYEV, Ya. A., SULTANKHODZHAYEV,  
A. N. and ZAKIROV, T., Earth Physics Institute imeni O. Yu. Schmidt, USSR  
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[Abstract] The reaction parameters of the underground water-gas system to a detonation of 2,550 tons of TNT set off 90 km from Urgench were investigated; its energy was  $10^{13}$  J. The magnitude of the displacement at 2.5 km from the epicenter was 12 mm for surface waves with a period of about 1 sec. This reaction was studied in a group of boreholes in the Koshabulakskaya structure located 10-12 km from the shot epicenter. The holes penetrated deposits from the Lower and Middle Jurassic to the Upper Cretaceous, the latter emerging at the surface. The structure is cut by two tectonic dislocations which divide it into three blocks. Most of the investigated waters were from artesian wells from such depths as 63-68 m and 200-208 m. Forty samples of gas and 40 samples of water were subjected to chemical analysis. Tables and figures give information on the chemical composition, temperature and yield of water and gas composition 5 days before and 5 days after the shot. Directly after the shot there was a change in the content of components of the chemical composition of waters and gases. The greatest variations were for such water parameters as temperature, total mineralization, pH, ions of chlorine, alkali metals and magnesium, and in the gases -- hydrogen and helium. Variations in the components of this water-gas system were evidently caused by slowed relaxation of the stressed-strained state of the zone along the fault. This relaxation, lasting not less than 20 hours, may be a result of LF oscillations of fluid pressure in the fault zone generated by the shot wave. After stabilization of the water-gas system there were residual changes of its individual parameters which still persisted at the end of five days. Zones along faults may be highly informative objects for study of hydrogeological and geochemical precursors of earthquakes. Figures 4, tables 2; references: 6 Russian. [207-5303]

UDC 551.583

# CRYOSPHERE AS WATER EXCHANGE SYSTEM

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 279, No 3, Nov 84  
(manuscript received 16 Dec 83) pp 587-590

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[Abstract] The cryosphere is no simple concept; it is part of the earth's water cycling system which must be thoroughly understood and taken into account in all climatic and environmental studies. The cryosphere can be represented as a "thermodynamic machine" in which the main source of energy is solar radiation, the main loss of energy is radiation into space and the working medium is water, which in different cyclic processes undergoes all types of phase transformations. It consists of a number of parts, such as the cryoatmosphere, which is a trap for water vapor, preventing its escape into space. Each of the other parts of the cryosphere has its water exchange functions. The cryohydrozone, in the polar regions represented by saline sea water at a negative temperature, constantly cools the depths of the ocean, forming an oceanic stratosphere which is separated from its upper tropospheric part by the pycnocline, emerging at the ocean surface in the polar front zones. Seasonal formations of the cryohydrozone favor the subsidence of subarctic and antarctic waters to considerable depths, with their outflow toward the equator and the formation of cold intermediate waters. The cryolithozone and glaciozone, containing all the subsurface and surface ice, participate directly in the planetary water exchange. Their formations include seasonally frozen soils and rocks, seasonal snow and ice on the land and brief and seasonal ice of fresh- and salt-water bodies, exerting a strong influence on the hydrological regime. With a thorough comprehension of the cryosphere it is possible to detect natural tendencies in regional water exchange, to evaluate long-term anthropogenic consequences and to evaluate scientifically sound recommendations on increasing efficiency of use of local and redistributed water resources. Only a full appreciation of the innumerable ramifications of the cryosphere will make it possible to develop a strategy for solving the problems involved in water supply at a national scale for the remote future. References: 12 Russian.  
[213-5303]



## ELASTIC WAVE VELOCITIES IN POROUS PERIODIC MEDIA

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ZEMLI in Russian No 5, May 84  
(manuscript received 9 Feb 82) pp 85-90

SIBIRYAKOV, B. P., MAKSIMOV, L. A. and TATARNIKOV, M. A., Geology and  
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Siberian Geophysical Expedition, Ministry of the Petroleum Industry

[Abstract] With respect to the propagation of elastic waves in multicomponent porous bodies, in an earlier review of the literature it was demonstrated that the key problem in modeling the physical properties of porous media is constructing a model of the empty skeleton. In this article the authors compute the elastic properties of empty skeletons, as a point of departure using the elastic properties of the solid phase (matrix) and structure of the pore space. (Such problems have previously been solved in only some very special cases.) The problem is formulated as follows. Assume that there is some microinhomogeneous periodic structure with a matrix characterized by the parameters  $\lambda_0$ ,  $\mu_0$ ,  $\rho_0$  and with the spatial periods  $h_1$ ,  $h_2$ ,  $h_3$  respectively in the coordinates  $x$ ,  $y$ ,  $z$ . As a simplification it is assumed that  $h_1 = h_2 = h_3 = h$ . One or more pores of an arbitrary configuration are situated within a period. A study is made to determine the mean tensor of stresses in the example of one pore per period. This makes it possible to determine the velocities of P and S waves in a microinhomogeneous body. After setting the boundary conditions, a method is given for determining the velocities of elastic waves using data from solution of static problems. It is shown that the problem of computing the elastic constants can be reduced to mixed problems in potential theory. Specifically, the problem of determining velocities in microinhomogeneous periodic structures essentially involves solution of the system of equations derived in this article. The theoretical data are compared with experimental findings obtained using two-dimensional models consisting of sheets of Duralumin and plastic and satisfactory agreement was found. Figures 2; references 8: 5 Russian, 3 Western.  
[211-5303]



UDC 550.837

APPLICATION OF COMBINED NUMERICAL METHOD IN EXAMPLE OF ONE PROBLEM IN  
GEOELECTRICS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ZEMLI in Russian No 5, May 84  
(manuscript received 7 Dec 82) pp 73-80

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imeni P. P. Shirshov, USSR Academy of Sciences

[Abstract] The authors solve a problem in geoelectrics whose distinctive feature is that there is no limit on the region of solution and the background surrounding the region with conductivity inhomogeneities is uniform. Such a problem is an evaluation of the influence of surface-layer changes in the earth's conductivity on the electromagnetic field carrying information on the lithosphere and asthenosphere. In such cases it is possible to examine a model of the earth in which the surface layer, containing conductivity anomalies (sedimentary cover, hydrosphere), is replaced by an infinitely thin envelope with a variable total conductivity. In such a model the Maxwell equations are reduced to a Price equation describing the behavior of the current function in a conducting film on both sides of which there is an insulator. In the case of long-period variations carrying information on deep conductivity the magnetic fields of currents flowing in the inhomogeneous layer can be neglected. Then the Price equation (with a temporal dependence  $e^{-i\omega t}$ ) has the form  $\text{div} (S^{-1} \text{grad} \Psi) = i\omega B_n^e$ , where  $\Psi$  is the current function,  $S$  is specific surface conductivity,  $B_n^e$  is the component of the external stipulated magnetic field normal to the layer. Only a plane layer is examined. Then the problem of the distortions introduced into the primary (normal) field by the inhomogeneities concentrated in the restricted region  $G_1$  with the boundary  $\Gamma_1$  involves finding a solution of the Price equation given above on the entire plane coinciding at infinity with the normal solution  $w$  ( $w$  is the solution of the Price equation in the absence of inhomogeneities  $S$  in the  $G_1$  region). The problem is solved (an example is given) by using the finite elements method in combination with the Schwarz alternating method. Figures 4; references: 6 Russian.  
[211-5303]

UDC 550.372

DETERMINING CONDUCTIVITY TENSOR IN ANISOTROPIC THREE-DimensionALLY  
INHOMOGENEOUS MEDIUM. LINEAR APPROXIMATION

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ZEMLI in Russian No 5, May 84  
(manuscript received 10 Jun 82) pp 63-72

ROMANOV, V. G. and SAVIN, M. G., Computer Center, Siberian Department, USSR  
Academy of Sciences; Computer Center, Far Eastern Scientific Center, USSR  
Academy of Sciences

[Abstract] The problem of determining the conductivity tensor in a case when the properties of the medium are dependent only on the vertical coordinate was examined in an earlier article (V. G. Romanov, et al., IZV. AN SSSR: FIZIKA ZEMLI, No 9, pp 84-94, 1983). However, in geoelectric research the real objective of investigations is three-dimensional inhomogeneities of conductivity in the crust and in the ionosphere; an example would be interpretation of data registered by geophysical magnetohydrodynamic generators. The need for further development of mathematical methods for solving boundary value problems in electrodynamics with allowance for three-dimensional inhomogeneity of the medium and anisotropy is evident. Proceeding on the basis of their earlier work, the authors now examine the case of a weak three-dimensional inhomogeneity of an anisotropic medium. The electromagnetic field is excited by a pulsed current source. The inverse problem is investigated using the theory of perturbations. The algorithm proposed for its solution can serve as the basis of methods for interpreting data from magnetohydrodynamic generators in studying geoelectric inhomogeneities whose conductivity differs little from the conductivity of the surrounding medium. References: 8 Russian.  
[211-5303]

UDC 550.344.5

MOVEMENT OF ELASTICO-PLASTIC LAYER ON ELASTIC HALF-SPACE UNDER INFLUENCE OF  
TRANSVERSE SEISMIC WAVE

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ZEMLI in Russian No 5, May 84  
(manuscript received 10 Jun 83) pp 20-39

ZAYTSEV, L. P., Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy  
of Sciences

[Abstract] This is essentially a continuation of the author's earlier study entitled "Oscillations Arising Under the Influence of a Transverse Wave in a Plastic Layer Covering an Elastic Half-Space," IZV. AN SSSR: FIZIKA ZEMLI, No 11, pp 13-24, 1982. The same simple model of an elastico-plastic medium is used in this study in investigating the interaction of transverse waves in an elastico-ideally plastic medium. The model makes it possible to detect

analytically the principal qualitative differences in the behavior of elastic and elastico-plastic layers and also to analyze the solution in a wide range of amplitude-frequency characteristics of the exciting oscillation. The process is accompanied by the dissipation of energy and the formation of local zones of flowability. A study was made of the processes of reflection of a transverse wave from the free surface of an elastico-plastic layer and the plane of its contact with a more rigid elastic medium. The regularities of transformation of the transverse seismic wave by the surface and intermediate elastico-plastic layer are clarified. The most important finding from this investigation is the detection of the effect of a near-surface inelastic shear, which together with the shear of the elastico-plastic layer as a whole relative to the underlying elastic half-space described earlier can explain the appearance of inelastic movements along the strike of a stratum during seismic events. Figures 13; references: 5 Russian. [211-5303]

UDC 539.375+550.34.013.4+551.243+575.16

#### MODELS OF GIGANTIC FISSURES IN CENTRAL KYZYLKUM

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ZEMLI in Russian No 5, May 84 (manuscript received 17 Dec 82) pp 3-14

BYKOVTSSEV, A. S., ULOMOV, V. I. and CHEREPANOV, G. P., Seismology Institute, Uzbek Academy of Sciences; All-Union Scientific Research Institute of Drilling Techniques, Ministry of the Petroleum Industry

[Abstract] The Central Kyzylkum region is characterized by the presence of fields of dilatational stresses in the upper layer of the earth's crust. The existence of gigantic gaping fissures at the earth's surface in this area is in itself evidence of the operation of dilatational stresses. In this article the authors determine the quantitative relationships between the magnitude of the surface fissures and their depth of penetration and also establish a quantitative relationship between the parameters of the fissures and the stresses operative in the zone of their formation. The linear dimensions of the regions in which tectonic dilatational stresses occur, these giving rise to the gigantic fissures, are much greater than the fissures themselves, attaining tens and hundreds of kilometers. The unknown magnitude of the stresses is estimated on the basis of the dimensions of the fissures easily measured at the surface. Theoretical estimates of the depth of penetration are made as a function of the magnitude of the displacements along the fissures and the magnitude of the operative stresses. Figures 9; references 16: 15 Russian, 1 Western. [211-5303]

## CONSTRUCTING FOCUSING TRANSFORMATIONS OF NONSTATIONARY ELECTROMAGNETIC FIELDS

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 5, May 84 (manuscript received 4 Feb 83) pp 89-95

FILATOV, V. V., Geology, Geophysics and Mineral Raw Materials Scientific Research Institute, Novosibirsk

[Abstract] The following problem is formulated and solved. It is assumed that in a homogeneous half-space  $\Omega$  with the conductivity  $\gamma$  and the magnetic permeability  $\mu_0$  there is an inhomogeneity  $D$  with the conductivity  $\gamma_1 > \gamma$ . It is necessary to determine the position and configuration of the inhomogeneity using data obtained by the transient processes method. The problem, in essence, involves the retrieval of the density of secondary sources distributed in a half-space on the assumption that these sources are concentrated in a finite region  $D \subset \Omega$ . A solution is found by application of the principles of seismoholography. This method, it is shown, makes it possible to construct transformations resulting in focusing of the field for the retrieval of images when used in conjunction with the method of generation of an electromagnetic field. Examples of such retrieval are given. One of the variants of a system for such transformation is the visualization of nonstationary electromagnetic fields in which images are obtained by solution of a series of inverse problems in field generation, a method which has proved effective for media with contrasting conductivities. In the case of media with poor contrast it may be more effective to use a focusing method based on known procedures for interpreting data obtained in field generation methods. Algorithms therefore now exist for obtaining focusing transformations of several types. Figures 1; references: 10 Russian.

[242-5303]

## INVERSE PROBLEM IN SEISMOMETRY. CONSTRUCTION OF REGULARIZING OPERATORS AND ANALYSIS OF RESTORATION ERROR

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 5, May 84 (manuscript received 16 Jun 83) pp 81-88

VOSTRIKOV, Yu. N., Geology and Geophysics Institute, Siberian Department, USSR Academy of Sciences, Novosibirsk

[Abstract] Any solution of the inverse problem in seismometry requires writing of a regularizing operator, finding the conditions for determining the regularization parameters, analysis of restoration error, choice of best restoration methods, preparation of computer scheme and program, numerical

experimentation for checking previous steps and application of test program to real seismograms for solving specific problems in seismology. The first three of these steps in solution of the inverse problem were investigated for seismographs with galvanometric registry. It is shown that regularizing operators can be obtained which do not require zero initial conditions and an analysis of errors is presented for three restoration methods. If the instrument parameters are known precisely, the restoration method proposed by V. A. Perepelitsa (IZV. AN SSSR. FIZIKA ZEMLI, No 2, 1972) makes it possible to retrieve soil displacement in the distant zone with a maximum systematic error inversely proportional to the length of the selected seismogram time segment. Tables 1; references: 4 Russian.  
[242-5303]

UDC 551.24

#### GEODETTIC BASE FOR STUDYING EARTH'S PRESENT DYNAMICS

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 5, May 84 (manuscript received 2 Jun 83) pp 17-24

KUCHAY, V. K. and ZAKHAROV, V. K., Geology Institute, Tajik Academy of Sciences, Dushanbe

[Abstract] The principles for carrying out geodetic observations are examined with particular application to solution of problems in terrestrial dynamics. Only two-dimensional geodetic networks are examined. Computations of the tensors of deformations are made using the formulas for mechanics of a continuum as applied to macroscopic volumes of finite extent. Existing inhomogeneities of the medium are considered at least an order of magnitude less than the characteristic dimension of an elementary volume, an approach commonly used in the finite elements method. The following sections are included: deformations and rotations of quasi-continuous crystal volumes; deformations and rotations of two contacting quasi-continuous volumes; deformations and rotations of quasi-continuous volumes separated by active fault; deformations and rotations of three quasi-continuous volumes separated by two active faults. The cases analyzed show that in the solution of geodynamic problems it is necessary to have special geodetic constructions with a large number of excess measurements. New types of figures are proposed for such constructions: geodetic pentagons, hexagons and heptagons. The laying out of geodetic networks for such investigations must be preceded by thorough studies of structure and morphology for discriminating volumes quasi-homogeneous in their rheological properties. Careful network layout will make it possible to detect currently active faults and will assist in formulating inverse problems in geodynamics. Figures 1; references 10: 9 Russian, 1 Western.  
[242-5303]



UDC 550.311/.312

FACTS CONTRADICTING CONCEPT OF EXISTENCE OF ASTHENOSPHERE IN EARTH'S MANTLE

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 5, May 84 (manuscript received 26 Apr 83) pp 11-17

REZANOV, I. A., IlyeIT [expansion unknown], USSR Academy of Sciences, Moscow

[Abstract] Many facts have come to light during recent years which seem to refute the idea that a **layer** of reduced viscosity exists everywhere in the mantle or which suggests that it has a different character than has been commonly accepted. The sole objective of the article is to bring to the attention of geologists and geophysicists that the current state of knowledge concerning the structure of the mantle and processes in it is still fragmentary and ambiguous. The most promising approach for research is the combining of seismic observations on long profiles and magnetotelluric sounding. It remains to be determined whether in the mantle there is a reliable correlation between waveguides and conductive layers usually consistent with zones of partial melting. Research of this type is now required in ocean areas; in no other way will it be possible to ascertain to what degree the lithosphere of the oceans differs from the lithosphere of the continents. Crustal waveguides require further study; better results could be obtained by combining seismic and magnetotelluric soundings along the same profile. The dependence between reduced velocity and increased crustal conductivity must be quantitatively estimated. Sectors where crustal layers anomalous in their physical properties are accessible to drilling are situated (at 5-8 km) may be discovered. It is only after such layers have been penetrated by boreholes that it will be possible to confirm whether in the crust there are actually zones where there is a horizontal flow of material. In short, in the author's opinion, the joint and thorough study of mantle and crustal waveguides is becoming a geophysical task of the greatest priority.

References: 12 Russian.

[242-5303]

UDC 551.248.2(571.54/.55+571.61/.62)

NEOTECTONIC FORMS IN REGION OF BAYKAL-AMUR RAILROAD LINE

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russia. No 5, May 84 (manuscript received 6 May 83) pp 3-11

UFIMTSEV, G. F., Earth's Crust Institute, Siberian Department, USSR Academy of Sciences, Irkutsk

[Abstract] A map of the most recent tectonics of the region of the Baykal-Amur Railroad was compiled and serves as the basis for a detailed discussion of the neotectonics along the route. This area consists of both mountainous and lowland-platform sectors. Large arched uplifts play a major role in the



structure of the zone; these are complexes of neotectonic forms which can be described roughly as spherical surfaces with a large radius of curvature. A distinguishing feature of development of these large arches is a predominance of general uplifts which are stable in time but their areas have increased with time; the geological structure of the large arched uplifts is characterized by the occurrence of Jurassic-Cretaceous orogenic granitoids forming zones of tectonomagmatic activation. Other major neotectonic uplifts have a block structure of several types; asymmetric block uplifts, for example, have a deep structure close to that of the large arches and are experiencing isostatic uplifting. In the Baykal rift zone the most important structural elements are large intermont depressions, but there are also elongated transverse faults which extend into the region of the Siberian Platform and into the Selenga-Vitim zone; the tectonic relief of mountain uplifts in the rift zone has a higher hypsometric level than the surrounding territories. Another type of major neotectonic forms, characterized by combinations of uplifts and depressions, is zones of linear warping. The lowland-platform regions have a complex neotectonic structure; within the limits of the Siberian Platform there is a predominance of general uplifts in the form of large steps and along the periphery of platform regions there are zones of marginal dislocations; another significant variety of platform formations is zones of foothill folds. Tectonic processes in these areas are discussed. Figures 2; references: 27 Russian. [242-5303]

UDC 551.71/.72:551.7.033(470.21)

# BOUNDARY BETWEEN ARCHEAN AND PROTEROZOIC IN CENTRAL KOLA PENINSULA

Moscow SOVETSKAYA GEOLOGIYA in Russian No 12, Dec 84 pp 66-69

FEDOROV, Ye. Ye. and FEDOROVA, M. Ye., Aerogeologiya Geological Production Association

[Abstract] Various reasons dictate a reliable discrimination of the boundary between the Archean and Proterozoic formations on the Kola Peninsula. This problem is examined on the basis of a study of the so-called Keyvskiy synclinorium, made up of Upper Archean biotitic and garnet-biotitic gneisses of the Lebyazhinskaya suite (gneiss complex) and the Keyvskiy superposed downwarp, a zone filled with Proterozoic highly aluminiferous quartz-muscovite schists and quartzites of the Chervurtskaya, Vykchurtskaya and Pestsovotundrovskaya suites (schist complex). It is usually assumed that the gneiss and schist complexes constitute a unified continuous section of Proterozoic age whose formation occurred in the course of a single sedimentation cycle. However, such a conclusion was drawn prior to the availability of space and aerial photographs, from which it can now be seen that there is an unconformity of the general plan of these structures, a superposed character of the Keyvskaya zone and its association with a large regional fault. These and other facts indicate a younger age of the Keyvskiye schists, whose formation was associated with a structural reorganization occurring

after the Keyvskiy synclinorium. However, at the Interdepartmental Regional Stratigraphic Conference on Stratigraphy of the Precambrian in the Soviet part of the Baltic Shield (Petrozavodsk, 1982) the boundary between the Archean and Lower Proterozoic was drawn at the base of the third (Pestsovotundrovskaya) suite of the schist complex. The objective of this article is to demonstrate that in fact the boundary between the Archean and Lower Proterozoic should be drawn along the base of the Chervurtskaya suite of the schist complex. Figures 2; references: 7 Russian.  
[205-5303]

UDC 551.76.3+551.242.3(571.62)

#### STRATIGRAPHY AND STRUCTURAL POSITION OF PREDDZHUGDZHURSKIY DOWNWARP

Moscow SOVETSKAYA GEOLOGIYA in Russian No 12, Dec 84 pp 62-66

LEBEDEV, Ye. L. and KRICHEVETS, V. I., Geology Institute, USSR Academy of Sciences; Aerogeologiya Geological Production Association

[Abstract] The Preddzhugdzhurskiy downwarp, filled with volcanites of Cretaceous age, is located immediately to the south of the Ul'inskiy downwarp at the southwestern end of the Okhotsk-Chukot volcanogenic zone. The downwarp has a northeasterly strike and is associated with a northeasterly zone of faults in common with the Ul'inskiy downwarp and separated from it by the granitoids of the oastal (Pribrezhnoye) uplift. There has been a considerable dispute among geologists as to whether or not the Preddzhugdzhurskiy downwarp constitutes a part of the Okhotsk-Chukot volcanogenic zone. A study of the stratigraphy of the Cretaceous volcanogenic formations in the downwarp shows that these are volcanites with an angular unconformity and lenses of tuff-conglomerates which lie on more ancient strata, from the Archean and Early Proterozoic to the Jurassic, divided into four suites with a total thickness as great as 2,000-2,800 m. These are the Nemuykanskaya, Mageyskaya, Motarinskaya and Tunumskaya suites. (Figure 1 is a diagram of the geological structure of the downwarp; Fig. 2 is a stratigraphic section.) A comparison of the sections of Cretaceous volcanites in the Preddzhugdzhurskiy downwarp and the Ul'inskiy region reveals a great similarity. There is also a coincidence of the principal stages in manifestation of subaerial volcanism and their age, established on the basis of paleobotanical data. Moreover, in both regions the Cretaceous volcanites lie with an angular unconformity on all the more ancient formations. The Preddzhugdzhurskiy downwarp has a structure similar to the structure of the Ul'inskiy downwarp. On the basis of these and other data, the studied downwarp can now be confidently assigned to the Okhotsk-Chukot volcanogenic zone. Figures 2; references: 9 Russian.

[203-5303]

19 April 1985

## EARTHQUAKE FORECASTING STUDIES BASED ON ANIMAL BEHAVIOR

Moscow TRUD in Russian 27 Feb 85 p 3

KVYATKOVSKIY, O.

[Abstract] The article reports on plans for research at a bioseismologic survey area by an expedition of the Kazakh Academy of Sciences' Institute of Seismology. Studies of animal behavior in relation to earthquake precursor phenomena are to be conducted in this area, which is near Alma-Ata and will be the first of its kind in the USSR.

Doctor of Biological Sciences, Professor Pavel Iustinovich Marikovskiy, an eminent zoologist and naturalist of the Kazakh republic, is quoted in regard to the history and current objectives of bioseismology research in the USSR and abroad. Marikovskiy is the author of a popular-science book entitled "Animals Forecast Earthquakes." The 73-year old scientist is serving as a consultant at the survey area.

Marikovskiy related that experiments are being conducted in a number of countries for the purpose of ascertaining various animals' responses to electromagnetic waves, electric fields, gas odors and other direct precursor phenomena of earthquakes, as well as the mechanism by which animals sense such phenomena, including sounds that are inaudible to humans. In particular, zoologists seek to expand the list of geophysical precursor phenomena which animals are known to be capable of sensing. Creatures to be observed at the future survey area include mountain species of burrowing animals; birds; snakes; ants which burrow to depths as great as 50 meters; and marmots, for which a special area of steppe has been set aside.

FTD/SNAP

CSO: 1865/259

PHYSICS OF ATMOSPHERE

LASER "ELEKTRONIKA-01" FOR AIR POLLUTION CONTROL LIDAR

Moscow SOVETSKAYA ROSSIYA in Russian 16 Dec 84 p 2

[Text] Tomsk--A station for high-altitude sounding of the atmosphere began monitoring the purity of the air over Tomsk yesterday. Data on the distribution of industrial emissions in the atmosphere are obtained here with the aid of a multipurpose laser locator, or lidar, which is equipped with a large receiving mirror. Subsequent processing of the data makes it possible to determine sources of pollution.

Specialists of the Institute of Atmospheric Optics of the USSR Academy of Sciences' Siberian Branch taught the laser its new occupation. The laser beam proved to be capable of obtaining information on the condition of every layer of air, including the stratosphere. A special computer-based unit of the station makes it possible to read this information in a matter of seconds. No measuring method had such accuracy and operational efficiency in the 'pre-lidar' era.

Within the framework of a Soviet-Bulgarian research program, industry of the People's Republic of Bulgaria has begun the series production of a laser complex, the "Elektronika-01," which is based on the Tomsk lidar.

CSO: 1865/191

LIDAR STATION FOR HIGH ATMOSPHERIC PROBING IN TOMSK

Moscow IZVESTIYA in Russian 2 Jan 85 p 3

LEVITSKIY, L.

[Abstract] The lengthy article reports on the creation of the first station for laser probing of the high atmosphere, at the Institute of Atmospheric Optics of the Siberian Branch of the USSR Academy of Sciences, in Tomsk.

Doctor of Sciences Georgiy Mikhaylovich Krekov, deputy director of the institute, explained that the latest "Loza" lidar unit developed at the institute is capable of reaching beyond the troposphere. "Loza" is an acronym from the first letters of the words 'Laboratory of optical probing of the atmosphere', where the lidar units are developed. In addition to a more powerful laser, the latest "Loza" has a more sensitive receiver for recording reflected signals. The receiving chamber is said to stand about 3 meters high. Its concave mirror is one meter in diameter, which is twice as large as ones usually employed in lidars. The result is a fourfold gain in sensitivity.

This lidar is said to provide reliable information on atmospheric conditions, including aerosol content, up to an altitude of 8,000 meters, in the troposphere. Although the beam reaches into the stratosphere, the reflected signals from this level are too weak to be recorded, except in very favorable conditions. But it is said the institute's theorists have been able to construct models of the behavior of a laser beam in the stratosphere, from which computer simulations indicate it is entirely feasible to develop units which could provide information at levels up to 120,000 meters.

It is noted that many of the institute's associates are graduates of Tomsk University. It was here that initial studies were undertaken of the propagation of electromagnetic waves of the optical range in the atmosphere, in the infrared radiation laboratory of the university's physical-technical institute. This laboratory subsequently became the basis of the university's chair of opto-electronic instruments, which was headed by V. Zuyev, who is now an academician and director of the atmospheric optics institute.

The institute is said to have its own production facility for building special lasers and optical devices. Its experimental facilities include a unique vacuum chamber and a large aerosol chamber. It is said that scientists can simulate the atmosphere of any part of the Earth in these facilities. At the present time, associates reportedly are designing a lidar for comprehensive high-altitude probing which will be capable of measuring pollutants, the amount of ozone, and humidity. It will have an even more powerful laser, and a larger mirror. It is also mentioned that funds have been allocated for construction of a new high-altitude probing station, and that an observatory of the Hydrometeorological Center will be built next to it.

V. S'yedin, head of the institute's department of large-scale studies of the atmosphere, is also mentioned.

FTD/SNAP

CSO: 1865/202



UDC 550.388.2

RESULTS OF SIMULTANEOUS MEASUREMENTS OF ABSORPTION AND POLARIZATION OF  
RADIO WAVES REFLECTED FROM IONOSPHERE

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR: SERIYA FIZIKO-  
TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 4, 1984  
(manuscript received 15 Jul 82) pp 37-43

KHANDOVLETOV, I., Physical Technical Institute, Turkmen Academy of Sciences

[Abstract] The reasons of the noncoincidence of the observed and theoretically predicted polarization are very important in studying radio waves reflected from the ionosphere. In this article the author seeks a possible correlation between the polarization of radio waves and their absorption in the ionosphere. The E layer was selected for this study because during the daytime only the ordinary wave is observed. Absorption and polarization of radio waves reflected from the ionosphere were measured simultaneously for 3 days. The working frequencies were selected in such a way that they were 1.5 and 2 times greater than the gyromagnetic frequency. Observations were made hourly at each frequency (2.2 and 2.8 MHz) in sessions 3-4 minutes long. In each case the mean ratio of the axes ( $h$ ) and orientation of the longer axis ( $\gamma$ ) of the polarization ellipses and the absorption ( $L$ ) were computed. The measurement results were subjected to statistical analysis for determining the interrelationship between the hourly and diurnal changes in absorption in the ionosphere and corresponding polarization changes. In addition, observations were made during the solar eclipse of 29 April 1976 with simultaneous measurement of radio wave absorption and polarization during vertical sounding. It was found that a change in the effective frequency of electron collisions in the lower ionosphere exerts a significant influence on the polarization of reflected radio waves and diurnal variations of absorption and polarization are statistically related. With a constant plasma frequency  $\omega_N$  an increase in absorption results in an increase in the ratio of the axes of the polarization ellipse and rotation of its longer axis in the direction of the E-W line (for ordinary wave). Other significant correlations were found. During the eclipse the ratio of the axes  $h$  of the polarization ellipses increases. In comparison with an ordinary day (0.4), the  $h$  value during the eclipse increased to  $\sim 0.9$  and during the eclipse the orientations of the longer axis of the polarization ellipses were unstable. Figures 2, tables 3; references 10: 7 Russian. 3 Western.  
[173-5303]

UDC 550.338.2

## TURBOPAUSE AS SOURCE OF INTERNAL GRAVITY WAVES

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR, SERIYA FIZIKO-TEKHNIЧЕСКИХ, ХИМИЧЕСКИХ I GEOLOGICHESKIKH NAUK in Russian No 5, 1984 pp 32-36

KARADZHAYEV, Yu. and MUKHAMETNAZAROVA, A.

[Abstract] Turbopause variations play an important role in processes transpiring in the upper ionosphere. O. N. Savina (GEOMAGNETIZM I AERONOMIYA, Vol 22, No 3, 1982) published theoretical computations showing that when semitransparent  $E_s$  layers are present (with the development of turbulence) the turbopause can be a source of medium-scale internal gravity waves. Upon reaching the F region these waves affect the distribution of ionization, generating wave disturbances. The period of these medium-scale internal gravity waves and wavelength vary in the ranges: 5-90 min, 50-250 km (horizontally and 50-120 km (vertically)). The horizontal phase velocity has the property of dispersion and is equal to 100-200 m/sec; the vertical phase velocity is constant for all frequency components and under experimental conditions varies from 30 to 120 sec (most probable value 80 m/sec). The purpose of this study was experimental confirmation of the Savina hypothesis. The experimental data used were records of the frequency parameters of the  $E_s$  layer as a natural tracer of the middle-latitude turbopause and synchronous samples of the critical frequency of the F2 region. The data were obtained during simultaneous spatially separated sounding at two points with different bases. Observations were made in the summer of 1966-1969 in the Ashkhabad region. Data were subjected to spectral analysis. The energy spectra were computed by the entropy maximum method for the  $f_{0E_s}$ ,  $f_{pE_s}$  and  $f_{0F2}$  time fluctuations. The probability of existence of wave disturbances of F-region ionization is dependent on the intensity of turbulent mixing in the turbopause. With the activation of turbulence their probability increases and the periods of the HF components ( $T \leq 20$  min) correlate with the time scale of macroscale turbulent pulsations. The coincidence of time scales of HF oscillations does not mean that they are caused by the same processes in the E and F regions. In the first region, where well-developed turbulence exists, the variations of the parameters of the neutral gas with a characteristic time scale of less than 20-30 min for the most part are generated by turbulence, whereas in the F region they are generated by internal gravity waves. The experimental data fully confirmed the Savina hypothesis. Figures 3; references 16: 13 Russian, 3 Western. [209-5303]

UDC 550.388.8

## STUDY OF SPATIAL DISTRIBUTION OF AURORAS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 279, No 3, Nov 84  
(manuscript received 19 Mar 84) pp 580-582

KRAKOVETSKIY, Yu. K., NADUBOVICH, Yu. A., POPOV, L. N. and SHUMILOVA, N. A.,  
Siberian Terrestrial Magnetism, Ionosphere and Radio Wave Propagation  
Institute, Siberian Department, USSR Academy of Sciences, Irkutsk

[Abstract] Earlier publications contain data indicating a closeness of the coordinates of zones of anomalies in the spatial distribution of auroras and zones of anisotropy of physical properties of the crust and suggest that crustal structures exert an influence on formation of the spatial structure of auroras. This possibility was investigated in the example of the spatial structure of auroras in Noril'sk region, which differs substantially from the earlier studied Yakutia area, which is significantly dissimilar with respect to the complex of magnetic, electrical and other physical properties of the rocks making up the mantle and crystalline basement. Whereas Yakutia is associated with the world East Siberian Magnetic Anomaly, attributable to deep inhomogeneities, the Noril'sk region is characterized by the presence of regional and local magnetic anomalies caused by magnetization of the upper crust. The spatial distribution of auroras in the Noril'sk region was studied using a Lebedinskiy wide-angle camera. The survey was made in the visible wavelength region. With an auroral altitude of 110 km the maximum radius of the survey was 1,172 km. Films for five winter seasons were processed. A special isoline map of the frequency of occurrence of auroras was constructed in corrected geomagnetic coordinates. Crustal structure near the observation point has considerable anisotropy of physical properties having anomalously increased conductivity in comparison with the surrounding rocks, giving rise to a first anomalous zone. A second zone of anomalous distribution of auroras coincides with transition from the Siberian Platform to the West Siberian Plate. This is evidence supporting the idea that anomalies in the spatial distribution of auroras coincide with zones of crustal anisotropy. Figures 1; references: 11 Russian.  
[213-5303]

UDC 551.510.536

## 'FULL SHADOW' PHENOMENON IN EARTH'S UPPER ATMOSPHERE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 279, No 4, Dec 84  
(manuscript received 3 May 83) pp 832-834

KOLESNIK, A. G. and GOLIKOV, I. A., Siberian Physical Technical Institute,  
Tomsk

[Abstract] The "full shadow" phenomenon should arise as a result of diurnal rotation of the earth due to the noncoincidence of the geographical and

geomagnetic poles. This gives rise to a crescent-shaped region devoid of sources of ionization, excitation and heating of the upper atmosphere during the entire polar night in a particular hemisphere. This crescent-shaped full-shadow region lies between the convection boundary and the boundary not accessible for solar electromagnetic radiation. This region exists only in the interval 0-200°E in the northern hemisphere and 0-200°W in the southern hemisphere with a width from 0 to 10°. The width of the region and its extent can vary, depending on the state of the magnetosphere. The region of the full shadow has its maximum area in the period of the winter solstice in the northern hemisphere and the summer solstice in the southern hemisphere. With approach to the equinoxes the region disappears. The region exists the entire 24 hours in the allowed longitude sector and time interval. This helps to explain the mechanism of formation of the main ionospheric trough in the F region, as is indicated by mathematical modeling, specifically, a three-dimensional magnetohydrodynamic model of the high-latitude F region which makes it possible to take the noncoincidence of the geographical and geomagnetic poles into account. The model computations show a marked decrease in the electron concentration (as much as two orders of magnitude) in the region coinciding with the full shadow zone. The model computations are confirmed by experimental data. The modeling confirms that the main ionospheric trough is formed due to the full shadow phenomenon. The latter can also help to explain the formation of the high-latitude lower ionosphere (D and E regions), behavior of minor constituents of the upper atmosphere, including metastable particles and atmospheric glow. It should also play an important role in the physics of solar-terrestrial relationships. Figures 3; references 9: 4 Russian, 5 Western.

[201-5303]

ARCTIC AND ANTARCTIC RESEARCH

AERIAL EXPEDITION SUPPLIES ARCTIC DRIFTING STATIONS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 18 Jan 85 p 2

[Article by N. Kanstantinov]

[Text] Leningrad, January 17--Only bright polar auroras occasionally break the darkness of the polar night over the Soviet drifting scientific stations "Severnny polyus-26" (SP-26) and "Severnny polyus-27" (SP-27). Thirty polar researchers have stayed here for the winter. Transport operations for supplying them in unusually difficult conditions have been completed by participants in the high-latitude aerial expedition "Sever-36", who returned to Leningrad today.

Specialists do not rule out the possibility that the cold waves which descended on countries of the Northern Hemisphere in January are a direct consequence of unusually active atmospheric processes which were noted in the Arctic in the fall and early winter. Winds of hurricane force have broken up the drifting stations' ice floes repeatedly, piling up ice hummocks around the floes. Many times, the polar explorers have had to build runways for airplanes, only to have the runways broken by cracks in the ice a few days or even hours afterward.

Despite these conditions, airplanes of the "Sever-36" expedition were able to make a number of flights to the "SP-26" station, with intermediate landings on tiny Zhokhov Island in the De Long Archipelago. This station is now drifting in the area of the so-called pole of relative inaccessibility, 1,500 kilometers from the continental coast. But no landings were managed at "SP-27", whose route passes far to the north of the New Siberian Islands; all cargo items, including New Year's trees, gifts and mail, were dropped from airplanes. Several dozen tons of fuel, food supplies and scientific equipment were delivered to both stations.

FTD/SNAP  
CSO: 1865/202



IL-14 AIRPLANES SUPPLY SP-26 DRIFTING STATION

Moscow IZVESTIYA in Russian 11 Dec 84 p 1

[Text] Pevek--Pilots of the Kolyma-Indigirka aviation enterprise have set up a 1,000-kilometer air route over the Arctic.

The crew of an IL-14 airplane under the command of Pilot 1st Class Yuriy Klepikov delivered the first load of cargo from Zhokhov Island to the personnel of the "Severnny polyus-26" drifting scientific research station.

The day before, the landing strip of the ice floe on which the station is located was damaged by shifting ice, and the cargo for the polar scientists was dropped by parachute in special containers.

"This station began its polar tour of duty on May 21 of last year," said S. Kessel', head of the high-latitude expedition "Sever-36". "Since then, its drift in the waters of the Arctic has extended more than 1,000 kilometers. The ice floe on which the scientific settlement of the polar explorers is located is moving ever farther to the north, towards the pole of relative inaccessibility. Airplane crews of our expedition are to deliver about 20 tons of various cargo items to the polar scientists, including scientific equipment, diesel power stations, and food."

FTD/SNAP  
CSO: 1865/202



#### AERIAL EXPEDITION TO SUPPLY ARCTIC STATIONS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Feb 85 p 2

[Text] Leningrad -- With the rising of the sun following the long polar night, the roar of engines is heard again over the ice-covered Arctic Ocean. The high-latitude aerial expedition "Sever-37" has begun its work here.

Airplanes of this expedition are to land scientific groups at almost 200 points of the polar basin for the purpose of gathering information on natural processes in the ocean and atmosphere and the condition of ice cover. This is necessary for the checking and refinement of mathematical models of the Arctic's weather and climate and the forecasting of navigation conditions along the Northern Sea Route.

The expedition has also been assigned the task of supplying and replacing the personnel of the drifting stations "Severnnyy polyus-26" and "Severnnyy polyus-27". These scientific communities on ice floes are now located at a great distance from airfields on the mainland; an intermediate base for flights to the stations is therefore being created on a frozen lagoon of tiny Zhakhov Island in the De Long Archipelago. In the meantime, runways are being built by the polar explorers of the drifting stations, which have experienced several breakups and movements of the ice this winter. The work of the high-latitude expedition "Sever" will last until the end of May.

FTD/SNAP  
CSO: 1865/259

RESULTS OF TESTING OF "AKVAMARIN" ICE RECONNAISSANCE RADAR

Moscow TRUD in Russian 8 Feb 85 p 4

[Article by M. Chudina]

[Excerpt] New radar instruments for measurement of the thickness of sea and fresh-water ice have been introduced into ice-reconnaissance practice for the first time by Leningrad hydrologists.

The new instrument was developed especially for hydrologists at the Riga Institute of Civil Aviation Engineers. It probes ice with a radar signal. It produces a double reflection -- from the outer surface of the ice and from the water. Antennas fastened to the side of the airplane pick up these reflections and transmit them to an oscillograph. Knowing the rate and time of the signal's passage through the ice, hydrologists can calculate the ice's thickness very quickly.

A large group of scientists, engineers and hydrologists were awarded the USSR State Prize for development of airborne radar instruments for measurement of the thickness of sea and fresh-water ice. Leningrad hydrologists are among the laureates.

The testing of this new instrument was assigned to specialists of the Arctic and Antarctic Scientific Research Institute of Leningrad. Among the first to test it were N. Komov and A. Balabayev, senior engineers, and also A. Chizhov, senior science associate of the State Hydrology Institute. They have been working in ice reconnaissance for more than 15 years. They had to evaluate the instrument's capabilities and check the precision of its readings in practice.

It must be said that the hydrologists found the instrument to be unusually 'capable.' Its designers did not suspect that their development possessed a whole series of latent capabilities. The researchers established that more than just the thickness of ice cover can be measured, using the radar method. The instrument is capable not only of precisely recording even the most inconspicuous ice hummocks, but also of distinguishing ice on the basis of its salinity. It makes all of these measurements quickly, substantially reducing inspection time and facilitating the work of reconnaissance teams.

The Leningrad hydrologists devoted much effort to 'teaching' the instrument how to operate so precisely and reliably. Engineers had to improve its design more than once in line with the hydrologists' recommendations. But now all of the testing is behind them. During the present shipping season, the thickness of shore ice from Dickson to Kolyma was evaluated in only five days with the aid of the "Akvamarin", as the latest model of the instrument is called.

The instrument has already become part of the standard equipment of ice-reconnaissance airplanes.

FTD/SNAP  
CSO: 1865/233

#### BRIEFS

ARCTIC SUPPLY AIRLIFT--The work of the high-latitude air expedition Sever-36 ended in the Arctic. Expedition aircraft, after almost 40 flights, delivered foodstuffs, fuel, instruments, and equipment necessary for work in the conditions of the polar night from the coastal base to the drifting stations SP-26 and SP-27. Conditions for the pilots' work are particularly complex at the present time due to low temperatures, squall winds, and fissures which break up the landing strips and have to be repaired continually. A proportion of the cargo had to be dropped by parachute to the icefloe where the SP-26 station drifts. [Text] [Moscow Domestic Service in Russian 1930 GMT 15 Jan 85 LD]

CSO: 1865/231

AERIAL SCOUTS GUIDE SHIPS WITHOUT ICEBREAKER ESCORT

Moscow VOZDUSHNYY TRANSPORT in Russian 29 Jan 85 p 4

MURLIN, A.

[Abstract] The article gives an account of a recent aerial reconnaissance operation which enabled a convoy of six cargo vessels in ice-covered waters to reach the port of Magadan, after the icebreaker which had been escorting the convoy left in order to replenish its own supplies. In the course of this operation, ice scouts on board an IL-14 airplane found a route through which the convoy could proceed through the Sea of Okhotsk. The airplane carried a team of hydrologists of the Kolyma Territorial Administration for Hydrometeorology and Monitoring of the Natural Environment.

It is mentioned that continuous ice reconnaissance of the shipping route running from the Kamchatka Peninsula to the southern tip of Sakhalin Island is being performed during the winter by similar teams of aviators and hydrologists on board airplanes. Each airplane flies at an altitude of 100-200 meters for 10-12 hours at a time. Ice scouts were also flying over the Tatar Strait, the Chukchi Peninsula and the Bering Sea, and near the Kuril Islands.

The airplane in the account flew at an altitude of 200 meters and was in the air for 10 hours. The hydrologists on board made a visual survey of the approaches to the port of Magadan, measured the temperature of the sea's surface with the aid of a radiometer, and prepared a forecast of ice conditions.

FTD/SNAP  
CSO: 1865/251

UDC: 551.845+551.8/5-18

DATA ON THE FORMATION OF LOESS-ICE MASSES IN NORTHERN YAKUTIA AND MAMMOTH  
FAUNA ENVIRONMENT IN ARCTIC IN LATE PLEISTOCENE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 278, No 6, Oct 84  
(manuscript received 28 Mar 84) pp 1446-1449

TOMIRDIARO, S. V., ARSLANOV, Kh. A., CHERNEN'KIY, B. I., TERTYCHNAYA, T.V.  
and PROKHOROVA, T. N., Northeast Complex Scientific Research Institute, Far  
Eastern Scientific Center, USSR Academy of Sciences, Magadan; Geography  
Scientific Research Institute, Leningrad State University imeni A. A.  
Zhdanov

[Abstract] Until recently science had no firm facts to substantiate occupation by mammoths and mammoth fauna in the arctic latitudes during stages of maximal cooling of climate and glaciation, nor development of productive steppes in the same area. These data have now become available as a result of the authors' detailed studies of rich bone remains in deposits of the loess-ice complex in the arctic sector of Yakutia. In recent years the genesis of these sediments has been completely rethought. Whereas recently they were considered to be lacustrine-alluvial, they are now considered to be cryogenic-colian deposits. This agrees completely with the new paleographic concept of the development of an arctic-steppe environment in this area. The authors' finding of mammoth bones in the loess horizon dated about 21,600 years ago indicates that these animals inhabited the region of the contemporary Lena River delta at 72°N during an extremely cold time of the Late Pleistocene. Similar dating of other well-preserved findings about 19,000 to 20,000 years old on the islands of Severnaya Zemlya give evidence of still deeper penetration into the arctic. However, the authors' finds of bones represent the first findings of mammoth remains with stratigraphic correlation in the surrounding deposits. Figures 1, tables 1; references 9: 8 Russian, 1 Western.  
[140-6508]

CSO: 1865

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